

1. Design features and special characteristics

Deep groove ball bearings are very widely used. A deep groove is formed on each inner and outer ring of the bearing enabling them to sustain radial and axial loads in either direction as well as the complex loads which result from the combination of these forces. Deep groove ball bearings are suitable for high speed applications.

In addition to unsealed bearings, deep groove ball bearings include ball bearings with greased sealed inside (sealed or shielded) and bearings with a snap ring that simplify structure around the bearing and design.

Table 1 shows the construction and special characteristics of various sealed deep groove ball bearings.

Table 1 Sealed ball bearings: construction and characteristics

Type, code no.	Shielded type	Sealed type			
	Non-contact type ZZ	Non-contact type LLB	Contact type LLU	Low torque type LLH	
Construction					
	<ul style="list-style-type: none"> • Metal shield plate is affixed to outside ring; inner ring incorporates a V-groove and labyrinth clearance. 	<ul style="list-style-type: none"> • Outer ring incorporates synthetic rubber molded to a steel plate; seal edge is aligned with V-groove along inner ring surface with labyrinth clearance. 	<ul style="list-style-type: none"> • Outer ring incorporates synthetic rubber molded to a steel plate; seal edge contacts V-groove along inner ring surface. 	<ul style="list-style-type: none"> • Basic construction the same as LU type, but specially designed lip on edge of seal prevents penetration by foreign matter; low torque construction. 	
Performance comparison	Torque	Low	Low	Rather high	Medium
	Dust proofing	Very good	Better than ZZ-type	Excellent	Much better than LLB-type
	Water proofing	Poor	Poor	Very good	Very good
	High speed capacity	Same as open type	Same as open type	Limited by contact seals	Much better than LLU-type
	Allowable temp.range ①	Depends on lubricant	-25 ~ 120	-25 ~ 110	-25 ~ 120

① Please consult NTN Engineering about applications which exceed the allowable temperature range of products listed on this table.

Note : This chart lists double shielded and double sealed bearings, but single shielded (Z) and single sealed (LB, LU, LH) are also available.

Grease lubrication should be used with single shielded and single sealed bearings.

2. Standard cage types

As shown in **Table 2**, pressed cages are generally used in deep groove ball bearings. Machined cages are however used for large bearings and high-speed bearings.

Table 2 Standard cage for deep groove ball bearings

Bearing series	Pressed cages	Machined cages
67	6700 ~ 6706	
68	6800 ~ 6834	6836 ~ 68 / 600
69	6900 ~ 6934	6936 ~ 69 / 500
160	16001 ~ 16052	16056 ~ 16072
60	6000 ~ 6052	6056 ~ 6084
62	6200 ~ 6244	
63	6300 ~ 6344	
64	6403 ~ 6416	

3. Other bearing types

3.1 Bearings with snap rings

Some bearings accommodate a snap ring which is attached along the outer diameter of the outer ring. By using snap rings, positioning in the axial direction is possible and housing installation is simplified. In addition to open type, shielded and sealed types are also manufactured. Consult NTN Engineering.

3.2 Expansion compensating bearings (creep prevention bearings)

The boundary dimensions of expansion compensating deep groove ball bearings are the same as for standard bearings, but formed high polymer material with a high expansion rate is provided in the grooves on the outer circumference of the outer ring (see **Diagram 1**).

Due to the extremely small difference of thermal expansion attained between the fitted surfaces of the high polymer equipped outer ring and the light alloy bearing housing, a good interference fit can be achieved with stable performance across a wide temperature range. Another

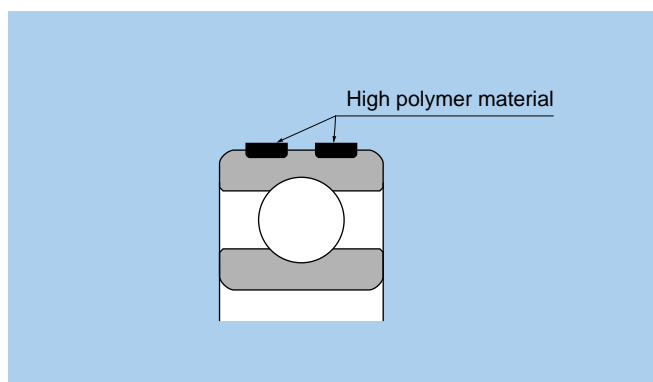


Diagram 1. Expansion compensating bearings

advantage is a large reduction in the occurrence of outer ring creeping.

(1) Allowable load

Maximum allowable load C_p (refer to the table of boundary dimensions) has been determined in accordance with outer ring strength; therefore, **it is necessary to select a bearing with a maximum allowable load greater than the largest anticipated bearing load.**

(2) Housing and bearing fit

Table 3 shows the recommended fits for bearings with light metal alloy housings.

In cases where the bearing is going to be interference fit with the housing, it is very important not to damage the high polymer material. Therefore it is essential that the lip of the housing diameter be given a 10° – 15° chamfer as shown in **Diagram 2**.

Furthermore, as shown in **Diagram 2**, it is also advisable to apply the interference fit using a press in order not force the bearing into the housing in a misaligned position. (**Diagram 2**)

(3) Radial internal clearance

Regulations for radial internal clearance are the same as those for standard deep groove ball bearings. For standard fit and application conditions, a C3 clearance is used with

Table 3 Recommended fits for outer ring and housing bore

Conditions		Suitable bearing	Housing bore tolerance class
Load type, etc.	Housing material		
Rotating outer ring load Rotating inner ring load; light load Direction indeterminate load; ordinary load	Al alloy Mg alloy Other light alloys	Deep groove ball bearing Cylindrical roller bearing	H6
Rotating outer ring load; heavy load Direction indeterminate load; shock load	Al alloy Mg alloy Other light alloys	Thick-walled type deep groove ball bearing	N6

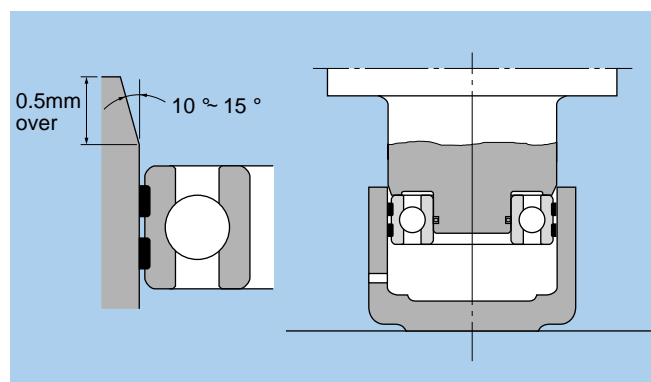


Diagram 2. Fitting method and housing inner diameter chamfer

this bearing.

For more detailed information concerning this bearing and the availability of roller bearings contact NTN Engineering.

(4) Allowable temperature range

-20 ~ 120°C

3.3 Long-life bearings (TMB/TAB bearings)

Boundary dimensions of long-life bearings are the same as those of standard deep groove ball bearings, but the bearings have undergone special heat treatment that considerably extends wear life.

These bearings are especially effective in countering reduced wear life due to the effects of infiltration by dust and other foreign matter.

Features are as follows:

- Rated load is the same as standard bearings, but shaft characteristics factor is $a_2 = 2.2$ for TMB bearings and $a_2 = 3.6$ for TAB.
- TMB 62 series bearings can be used in place of standard 63 series bearings enabling lighter weight, more compact designs
- Greater resistance to reduced wear life due to infiltration by dust and other foreign matter

Dimensions for these bearings are not provided in the dimensions table. For details, please contact NTN Engineering.

3.4 AC bearings (creep prevention bearings)

AC bearings have the same boundary dimensions as standard bearings with the addition of two O-rings imbedded

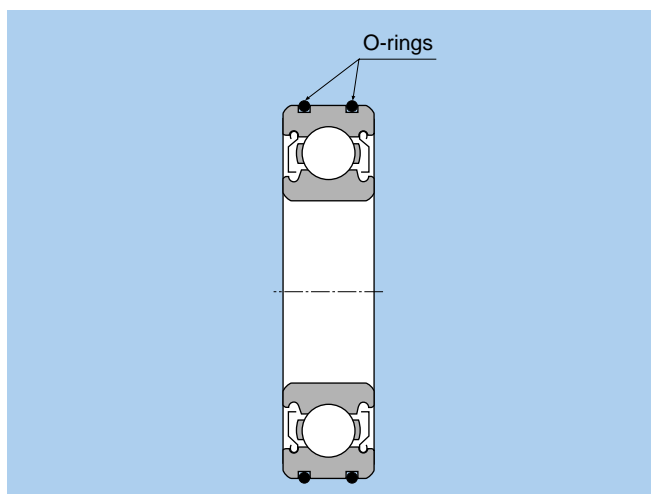


Diagram 3. AC bearing

in the outside circumference of the outer ring. (Diagram 3)

This bearing has a steel housing, can withstand rotating outer ring loads, and is suitable for applications where a "tight fit" is not possible but the fear of creeping exists. With its capacity for axial load displacement, an AC bearing can also be installed as a floating side bearing to accommodate shaft fluctuations. Before installing the bearing into the housing, high viscosity oil (base oil viscosity, 100 mm²/s or more) or grease should be applied to the space between the two O-rings. This lubricant forms a thin oil layer inside the bearing which prevents contact between the outer ring and housing, lowers the coefficient of friction, and is still able to prevent creeping by utilizing the friction force of the O-rings. Outer ring spin is prevented by friction force of the O-ring and housing.

For dimensional specifications, handling procedures, and other detailed information concerning AC bearings, contact NTN Engineering.

(1) Allowable load

Because allowable load C_p that takes outer ring strength into account (see dimensions table) is established, selection must be made so that maximum load on the bearing does not exceed C_p .

(2) Fit with housing

Table 4 gives recommended fit with steel housing.

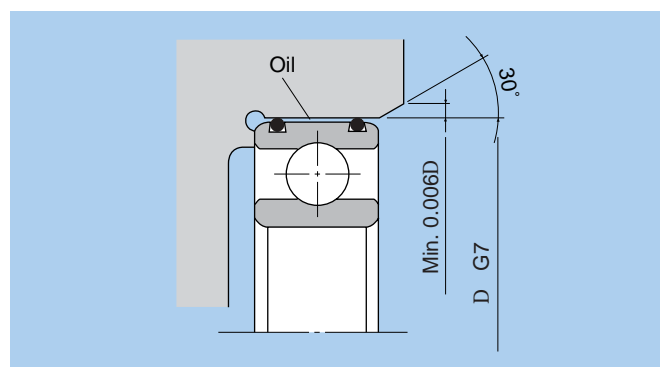


Diagram 4. Housing

Table 4 dimensions and shape

Housing bore tolerance	G7
Housing bore entrance chamfer	Max. 30°
Housing bore chamfer grinding undercut	Min. 0.006D
Housing bore finish roughness	2.5 μm Ra
Housing bore roundness	1/2 bearing housing dimension tolerance

(3) Allowable temperature range

-25 ~ 120°C