

The deep groove ball bearing

Summary

- Deep groove ball bearings are the most widely used bearing type
- They are used in many different ways in a wide variety of applications
- Suitable for high speed applications
- Bearing code: 6
- Axial (thrust) deep groove ball bearings can only support axial loads and are not suitable for high speeds
- Sealed deep groove ball bearings have grooves in the bearing rings that allow seals to be fitted

Characteristics of deep groove ball bearings

In its current form, the deep groove ball bearing has existed – subject to some optimisation – for about 150 years. However, deep groove ball bearings are not only one of the oldest [rolling bearing](#) designs, but also the most common bearing type and are therefore, so to speak, the classic among rolling bearings. They can be used in a wide variety of applications. Among other things, deep groove ball bearings are installed in electric motors, small gearboxes and PC drives. It is therefore very likely that you have already come into contact with deep groove ball bearings during your studies, training or career.

Deep groove ball bearings are non-separable bearings with deep raceways that are suitable for supporting both [radial and axial](#) loads from both directions. Accordingly, they can also

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*Like all rolling bearings, the deep groove ball bearing is composed of an **inner ring**, **outer ring**, **rolling elements** (balls) and a **cage**.*

support complex loads. These are loads resulting from the combination of radial and axial forces. When balls are used as rolling elements, they are in **point contact** with the **raceway** surfaces. In **rolling contact**, only a small area is stressed with each overrolling, which means that only a small amount of heat is generated. Deep groove ball bearings are therefore particularly suitable for applications with high speeds. In addition, these bearings can be **lubricated** with grease or oil. Last but not least, deep groove ball bearings are available in many sizes and designs. A characteristic disadvantage of ball bearings, on the other hand, is that the load capacity is limited due to the **point contact** of the rolling elements. Furthermore, deep groove ball bearings are sensitive to impact loads and they may have a relatively low **life expectancy**.

A deep groove ball bearing can always be recognised by the code number 6. It can be divided into eight different dimensional series. The dimensional series is identified by the second (or third for 160) digit of the **bearing designation** and indicates the width and diameter series of the deep groove ball bearing in each case. Regardless of the dimensional series, it is usual that the cages for smaller sizes are made of sheet steel unless otherwise stated. For some deep groove ball bearing series (especially for large bearings and bearings for high speeds), solid cages are mainly used. Incidentally, there are fixed rules for the pronunciation of bearing designations: For example, a deep groove ball bearing with the code number 6307 is verbally referred to as “sixty three oh seven”.

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Bearing series	Sheet steel cage	Solid brass cage
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	---

Deep groove ball bearings of series 68, 69, 160 and 60 are equipped with a solid brass cage as standard at NTN for larger sizes.



Axial deep groove ball bearings are defined with the code number 5 and a five-digit

Axial (thrust) deep groove ball bearing

A subgroup of deep groove ball bearings are thrust deep groove ball bearings. With regard to their design, the advantage is that these bearings are self-contained and consist of several parts (a shaft locating washer, housing locating washer, a ball and cage assembly).

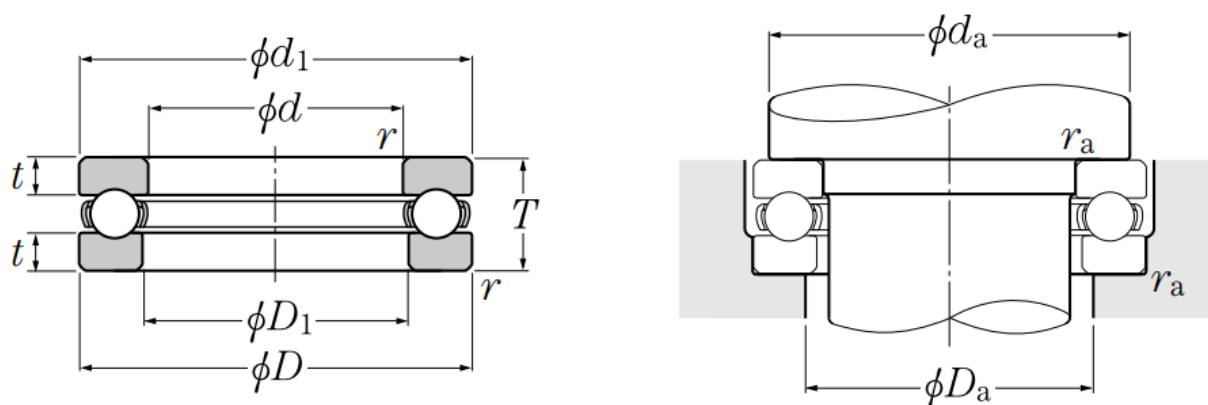
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bearing designation. This makes it possible to install the parts separately. The shaft washer of the bearings has a ground bore; in contrast, the bore of the housing washer is larger and turned. Both washers also have formed rolling bearing raceways, also called running grooves. As with conventional deep groove ball bearings, sheet steel cages are often installed in axial deep groove ball bearings. However, the use of other cage materials is also possible here. Axial deep groove ball bearings must be radially floating.

As can be assumed from the name, these bearings can only support **axial loads**. Depending on the design, these axial forces may act on one or both sides, but the bearings are not capable of supporting radial forces. In terms of their design, double direction axial deep groove ball bearings have one or two differences compared to single direction bearings. Although there is a shaft locating washer, there are two housing locating washers and ball and cage assemblies. Last but not least, they can guide the shaft to both sides.

Axial deep groove ball bearings usually have a **contact angle** of 90° and differ from standard deep groove ball bearings in that axial **preload** is necessary to prevent slippage between the rolling elements and the races. Bearings with a housing washer with a spherical outer diameter are basically able to compensate for misalignments that occur between the shaft and housing. Unlike radial ball bearings, axial deep groove ball bearings are not suitable for applications with high speeds.

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This is what the technical drawing of a single direction axial deep groove ball bearing looks like.

Types and codes		Shielded type		Sealed type	
		Non-contact type ZZ	Non-contact type LLB	Contact type LLU	Low torque type LLH
Construction					
		Metal shield plate is fixed to the outside ring; the inner ring incorporates a V-groove and labyrinth clearance.	The outer ring incorporates synthetic rubber molded to a steel plate; seal edge is aligned with V-groove along inner ring surface with labyrinth clearance.	The outer ring incorporates synthetic rubber molded to a steel plate; seal edge contacts V-groove along inner ring surface.	Basic construction is the same as LLU type, but a specially designed lip on the edge of the seal prevents foreign matter penetration; low torque construction.
Performance comparison	Torque	Small	Small	Higher	Medium
	Dust proofing	Good	Better than ZZ-type	Excellent	Much better than LLB-type
	Water proofing	Poor	Poor	Very good	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 to 120°C	-25 to 110°C	-25 to 120°C

Common *seal* types for deep groove ball bearings at a glance. In the lower part of the pictures you can see the V-shaped groove on the inner ring.

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Sealing of deep groove ball bearings

In this context, some basics on the subject of [seals](#) are also important. It is helpful to know that for attaching a seal, the inner ring has a V-shaped groove. The seal is attached on the opposite side, i.e. on the outer ring, and extends to the groove. It depends on the design of the seal whether and to what extent it touches the inner ring at the groove. During the rotation of the bearing and the associated effect of the [centrifugal force](#), the groove also serves to keep dirt on the outside. The [grease](#) in the bearing, on the other hand, is conveyed further inwards.

If you want to know more about this, you can find more detailed information in our chapter on [seals](#).

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Point and line contact

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What is meant by “point and [line contact](#)”? You may have already heard that rolling bearings can be split into two types. The classification depends

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