Self-aligning Ball Bearings

Detail Introduction :

Self-aligning ball bearings are two raceways of the inner ring and raceway for the spherical surface of the outer ring, assembled with spherical ball bearings.

The center of curvature of the outer ring raceway surface is the same as the center of the bearing, so it has the same alignment function as the self-aligning ball bearings. When the shaft or housing is deflected, it can be adjusted automatically without increasing the burden on the bearing. Spherical roller bearings can bear radial load and axial load in two directions. Radial load capacity is large, suitable for situations with heavy load and shock load. The inner ring inner diameter is tapered hole bearing, can be directly mounted. Or it can be mounted on cylindrical shaft by using tightening sleeve and dismantling cylinder. The cage uses steel plate stamping cage, polyamide forming cage and copper alloy turning cage.

Self-aligning ball bearings are mainly used to bear radial load, in the radial load at the same time, can also bear a small amount of axial load, but generally can not bear pure axial load, its limit speed is lower than the deep groove ball bearings. self-aligning ball bearings are mostly used in the load under the role of bending prone to double-branch bearing Self-aligning ball bearings are used in double-branch bearings that are susceptible to bending under load, as well as double-bearing seat holes that do not guarantee strict coaxiality, but the relative tilt of the centerline of the inner ring and the centerline of the outer ring shall not exceed 3 degrees.

Self-aligning ball bearings is skf bearing in a very superior performance of a bearing, its basic characteristics are as follows.

1.Common spherical ball bearings are double row spherical ball bearings, there is a large spherical groove outer ring, a double groove inner ring, two rows of steel balls and cage composition.

Self-aligning ball bearing has the characteristic of aligning performance, which is suitable for the transmission bearing where the shaft is easy to bend.

3. The maximum axis tilt of the inner and outer rings of self-aligning ball bearings cannot be greater than 3°.

4. Applicable to the speed is not high, no strict requirements for noise and vibration and inconvenient loading and unloading occasions.

5. The outer ring raceway surface is spherical, with spherical performance. Due to processing and installation and shaft bending caused by the shaft and seat hole different heart when suitable for this bearing, adjust the skew angle can be within 3 °.

6. Bearing contact angle is small, almost unchanged under the action of axial force, axial bearing capacity is small.

7. Spherical ball bearings and single full ball (no cage) with double-sided dust cover structure. This bearing aperture is not greater than 10mm, commonly used in aircraft frame construction, such as manipulating the wing, tail, both ends of the connecting rod. One-time lubrication, encapsulated can not be lubricated and replaced.

Among all skf bearings, Self-aligning ball bearing can be said to be a very prominent one, with very many superior performance, in the practical application of the advantages are also more obvious.

About the application of Self-aligning ball bearings.

The center of curvature of the outer ring raceway surface of the self-aligning ball bearing is the same as the center of the bearing, so it has the same alignment function as the self-aligning ball bearing. In the shaft, shell appears around the curve, can be automatically adjusted, not to increase the bearing burden. Self-aligning ball high-temperature bearings can withstand radial loads and axial loads in the second direction.

Therefore, Self-aligning ball bearings are suitable for those bearings that can occur considerable shaft deflection or misalignment, the use of occasions, such as fine appearance, low noise motors, automobiles, motorcycles, woodworking machinery, textile machinery drive shaft, mining machinery,

mechanical and electrical equipment, plastic machinery, work equipment, medical equipment, fitness and sports equipment and general machinery, etc..
Skf bearing processing plants all over the world, skf will be allocated according to the resources of each regional factory, so each factory can produce high quality skf bearings, on this basis, Self-aligning ball bearing has become a widely popular bearing type, to modern industrial processing production provides a very big convenience.
The following are the details of Self-aligning ball bearings.

Self-aligning ball bearings Designs and variants

SKF self-aligning ball bearing variants are:
open (fig. 1)

fig. 1

with a cylindrical bore
with a tapered bore, e.g. for use with adapter sleeves (fig. 2)

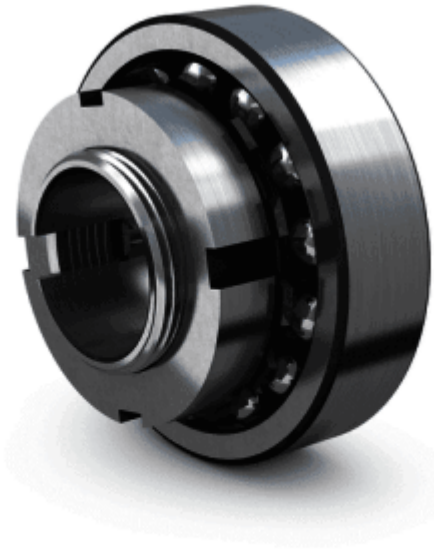


fig. 2

with an extended inner ring (fig. 3)

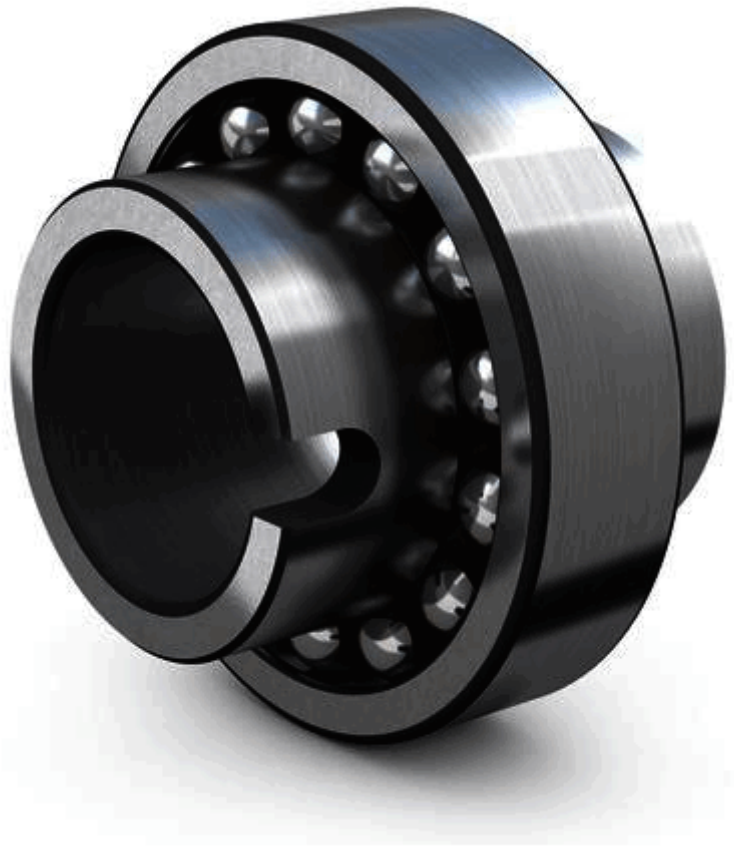


fig. 3

sealed (fig. 4)

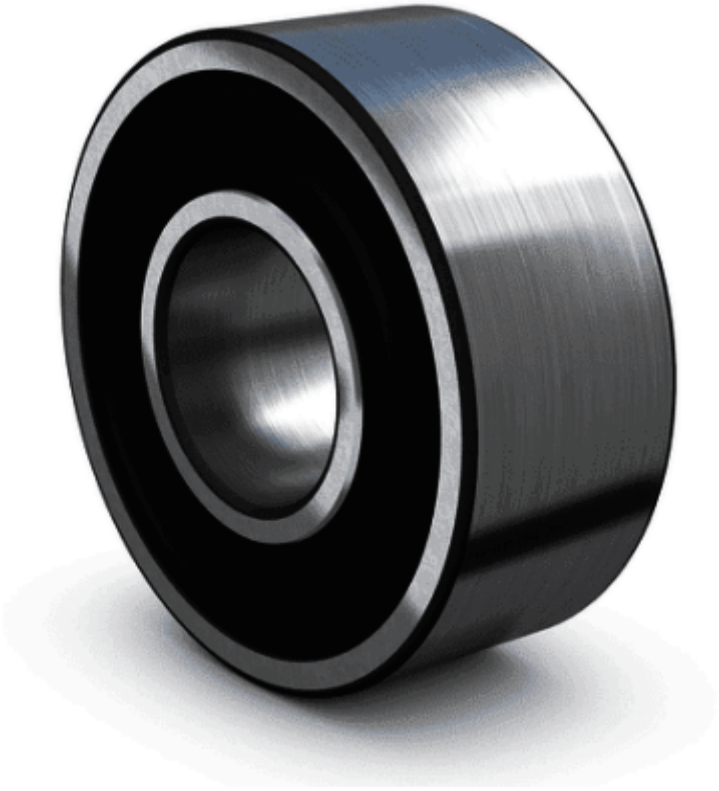


fig. 4

with a cylindrical bore
with a tapered bore, e.g. for use with adapter sleeves
Sealed bearings
Sealed bearings equipped with contact seals on both sides (fig. 5) are available:

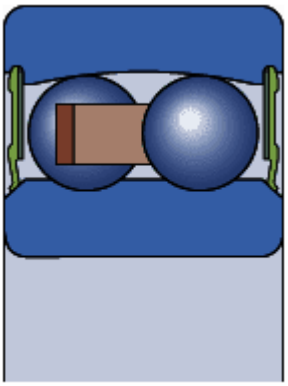


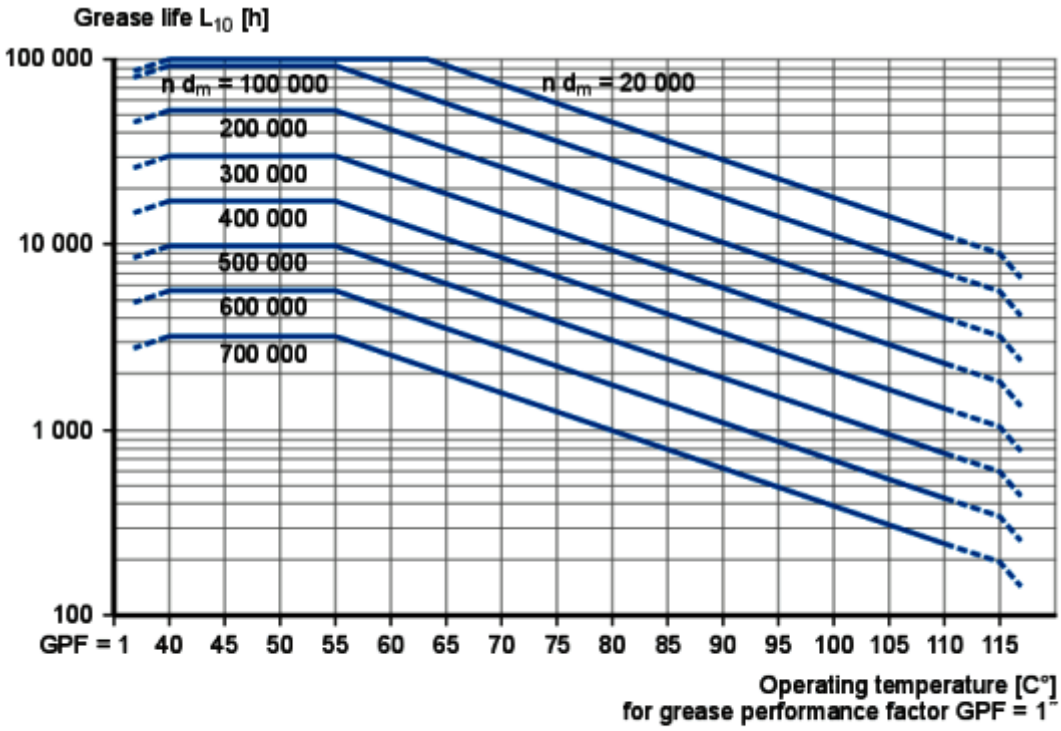
fig. 5

in the 22 and 23 series
with bore diameter 10 ? d ? 70 mm
with seals made of sheet steel reinforced NBR (oil and wear-resistant, designation suffix 2RS1)
Permissible angular misalignment of sealed bearings is slightly reduced compared to open design bearings.
Greases for capped bearings
Bearings sealed on both sides are lubricated for the life of the bearing and are virtually maintenance-free. They are filled with one of the following standard greases, which have good corrosion-inhibiting properties (table 1):

Bearing outside diameter [mm]	Grease	Temperature range[1]	Thickener	Base oil type	NLGI grade	Base oil viscosity [mm²/s] at 40 °C (105 °F)	at 100 °C (210 °F)
		–50 0 50 100 150 200 250 °C					
D ≤ 62	MT47		Lithium soap	Mineral	2	70	7,3
D > 62	MT33		Lithium soap	Mineral	3	100	10
		–60 30 120 210 300 390 480 °F					

table 1

D ? 62 ? MT47 grease
D > 62 ? MT33 grease
Grease life for capped bearings
is presented as L10, i.e. the time period at the end of which 90% of the bearings are still reliably lubricated
depends on the operating temperature and the speed factor (diagram 1)



n = rotational speed [r/min]
d_m = bearing mean diameter [mm]
= 0,5 (d + D)

diagram 1

horizontal shaft
inner ring rotation
light load (P ? 0,05 C)
operating temperature within the green temperature zone of the grease (table 1)

Bearing outside diameter [mm]	Grease	Temperature range[1]	Thickener	Base oil type	NLGI grade	Base oil viscosity [mm²/s] at 40°C (105 °F)	at 100 °C (210 °F)
		−50 0 50 100 150 200 250 °C					
D ≤ 62	MT47		Lithium soap	Mineral	2	70	7,3
D > 62	MT33		Lithium soap	Mineral	3	100	10
		−60 30 120 210 300 390 480 °F					

table 1

stationary machine
low vibration levels
Where the operating conditions differ, the grease life obtained from the diagram should be adjusted:
vertical shafts ? 50% of the obtained value
heavier loads (P > 0,05 C) ? apply reduction factor (table 2)

Load P	Reduction factor
? 0.05 C	1
0.1 C	0.7
0.125 C	0.5
0.25 C	0.2

When sealed bearings must operate under certain extreme conditions, such as very high speeds or high temperatures, grease may appear on the capping diameter. For bearing arrangements where this should be detrimental, appropriate actions could be taken. For additional information, contact the SKF application engineering service.
Large self-aligning ball bearings
are available in the 130 and 139 series
are equipped with an annular groove in the outer ring and (fig. 6):

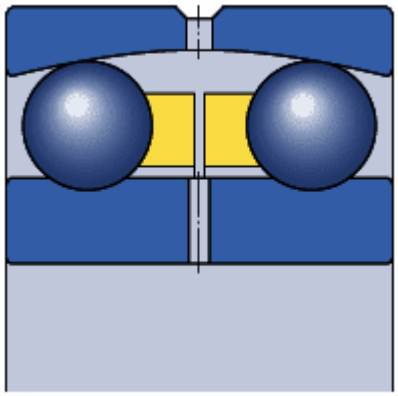


fig. 6

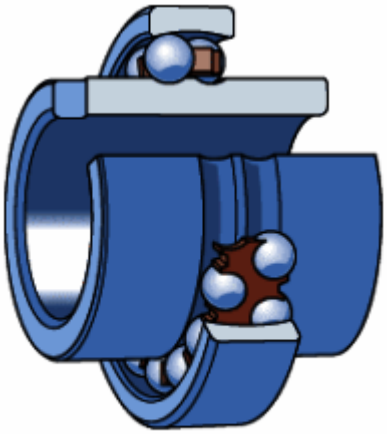


fig. 7

three equally-spaced lubrication holes in the outer ring
six equally-spaced lubrication holes in the inner ring
can be used in any application where low friction is preferred over high load carrying capacity (e.g. in the paper industry)
1.Bearings with an extended inner ring
fig. 7
are designed for less demanding applications that use commercial grade shafting
have a special bore tolerance, class JS7 (table 3), that facilitates mounting and dismounting
are located axially on the shaft by means of a slot at one end of the inner ring that engages a pin or shoulder screw (fig. 8) fitted to the shaft

Bore diameter		Tolerance class JS7	
d		Deviation	
>	?	U	L
mm		?m	
18	30	+10,5	–10,5
30	50	+12,5	–12,5
50	80	15	–15

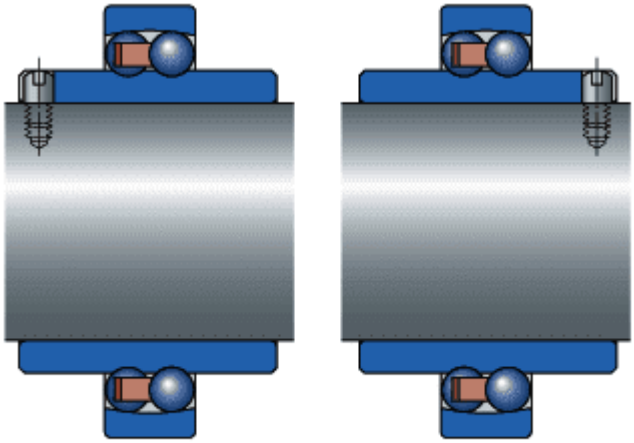


fig. 8

This also prevents the shaft from spinning in the bearing bore.

Cages

Depending on their series and size, SKF self-aligning ball bearings are fitted with one of the cages shown in table 4.

2.Self-aligning ball bearings Temperature limits

The permissible operating temperature for self-aligning ball bearings can be limited by:

the dimensional stability of the bearing rings and balls

the cage

the seals

the lubricant

Where temperatures outside the permissible range are expected, contact SKF.

Bearing rings and balls

SKF self-aligning ball bearings are heat stabilized up to 120 °C (250 °F).

Cages

Steel or brass cages can be used at the same operating temperatures as the bearing rings and balls.

Seals

The permissible operating temperature for NBR seals is –40 to +100 °C (–40 to +210 °F).

Temperatures up to 120 °C (250 °F) can be tolerated for brief periods.

Typically, temperature peaks are at the seal lip.

Lubricants

Temperature limits for the greases used in sealed SKF self-aligning ball bearings are provided in table 1. For temperature limits of other SKF greases, refer to Selecting a suitable SKF grease.

Bearing outside diameter [mm]	Grease	Temperature range[1]	Thickener	Base oil type	NLGI grade	Base oil viscosity [mm²/s] at 40 °C (105 °F)	at 100 °C (210 °F)
		–50 0 50 100 150 200 250 °C					
D ≤ 62	MT47		Lithium soap	Mineral	2	70	7,3
D > 62	MT33		Lithium soap	Mineral	3	100	10
		–60 30 120 210 300 390 480 °F					

table 1

When using lubricants not supplied by SKF, temperature limits should be evaluated according to the SKF traffic light concept.

3.Self-aligning ball bearings Permissible speed

The speed ratings in the product table indicate:

the reference speed, which enables a quick assessment of the speed capabilities from a thermal frame of reference

the limiting speed, which is a mechanical limit that should not be exceeded unless the bearing design and the application are adapted for higher speeds

For additional information, refer to Operating temperature and speed.

Operating temperature and speed

The relationships between the temperature and power loss of components within an application is complex and these factors, in turn, have interdependencies with many others such as bearing sizes, loads and lubrication conditions.

They influence many performance characteristics of an application and its parts, and do so in various ways depending on the operational state, such as at start-up or in normal operation, when steady-state conditions have been reached.

Estimating the operating temperature and verifying speed limitations is a critical aspect of the analysis of an application.

This section provides details of these primary relationships, and guidance on what to consider.

Bearing operating temperature and heat flow

Temperature has a major influence on many performance characteristics of an application. The heat flow to, from and within an application determines the temperature of its parts.

Appropriate bearing housings

Appropriate SKF bearing housings are available in a variety of designs and sizes for a wide range of applications. The designs include:

SNL, SE plummer (pillow) block housings in the 2, 3, 5 and 6 series

FNL flanged housings

SAF plummer (pillow) block housings for inch shafts

For additional information, refer to Bearing housings.

Skf bearings for various industries to provide high quality bearings, Self-aligning ball bearings whether in quality or in practicality have very outstanding advantages, Self-aligning ball bearings can play a very good support role, and can effectively reduce friction, the following are some of the common on Self-aligning ball bearings are the answer to some common questions about.

1.What is a self aligning ball bearing used for?

Self-aligning ball bearings have two rows of steel balls, the inner ring has two raceways, the outer ring raceway for the inner spherical shape, with the performance of self-aligning. It can automatically compensate for the coaxiality error caused by the deflection of the shaft and the deformation of the shell, and is suitable for the part where the support seat hole cannot guarantee strict coaxiality.

Self-aligning ball bearings are mainly used to bear radial load, in bearing radial load at the same time, can also bear a small amount of axial load, but generally can not bear pure axial load, its limit speed is lower than the deep groove ball bearings. This type of bearing is used in the load under the role of easy to bend the double-supported shaft, as well as the double-supported seat hole can not ensure strict coaxiality of the parts, but the inner ring centerline and outer ring centerline relative tilt shall not exceed 3 degrees.

Therefore, Self-aligning ball bearings are suitable for bearing heavy loads and impact loads, precision instruments, low-noise motors, automobiles, motorcycles, metallurgy, rolling mills, mines, petroleum, paper, cement, sugar, and other industries and general machinery.

2.How do you install self-aligning bearings?

Self-aligning ball bearings are bearings with drum rollers assembled between the inner ring of two raceways and the outer ring of the raceway for the spherical surface. The center of curvature of the outer raceway surface and the center of the bearing are the same, so it has the same alignment function as the self-aligning ball bearings. Its main mounting methods are two: press-in mounting and heating mounting.

Press-in installation, press-in installation is to install the bearing on the shaft first, when installed in the face of the bearing section put some metal material, smashed in with a hammer.

Heating installation, using the principle of thermal expansion to install the bearing, but when heating the bearing should pay attention to the oil temperature is not too high. The general bearing certificate of conformity has the installation and use method at the back.

It is worth noting that when mounting the bearing with shaft into the box shaft hole, using the middle mounting ring can prevent the outer ring from tilting and rotating, it should be remembered that some

sizes of Self-aligning ball bearing have the ball protruding from the side of the bearing, so the middle mounting ring should be recessed to prevent the ball from being damaged, a large number of bearings are generally mounted by mechanical or hydraulic press-in method.
For separable bearings, the inner ring and outer ring can be installed separately, which will effectively simplify the installation process, especially when the inner and outer ring are required to interference fit, in the inner ring has been installed in place when the shaft is installed into the bearing box containing the outer ring, must pay attention to see whether the inner and outer ring is correctly aligned to avoid scratching the bearing raceway and rolling parts.

3.What are the differences between spherical roller bearings and Self-aligning ball bearings?

First of all, spherical roller bearing is a double row non-separable bearing, its structure includes solid outer ring with spherical raceway, solid inner ring and drum roller with cage, inner ring has cylindrical hole or tapered hole. The symmetrical drum rollers can be freely adjusted in the spherical raceway of the outer ring. Therefore, it can compensate the bending of the shaft and the misalignment of the mating surface.
Self-aligning ball bearing is the outer ring raceway processing into spherical shape, the inner ring has two deep groove raceway double row ball bearing, with spherical performance, belong to the non-separable bearing. Mainly used to bear radial load, in bearing radial load at the same time, can also bear a small amount of axial load, but generally can not bear pure axial load, its limit speed is lower than the deep groove ball bearings.
The same point of these two bearings is that they have the performance of self-aligning, both are double row rolling body, the main differences are.
1.Rolling body form is different: the rolling body of spherical roller bearing is roller, the rolling body of spherical ball bearing is ball.
The bearing capacity is different: Self-aligning ball bearing mainly bears radial load, while bearing radial load, can also bear a small amount of axial load, but generally can not bear pure axial load, rated load ratio of 0.6 to 0.9. Spherical roller bearing mainly bears radial load, but also can bear certain axial load, rated load ratio of 1.8 to 4.0. 4.0.
3.Different use environment: Spherical roller bearings have higher bearing capacity than spherical ball bearings, which are suitable for low speed and heavy load conditions; spherical ball bearings are suitable for high speed and light load conditions.

4.What can be used in self-aligning applications where the load carrying capacity of ball bearings is insufficient?

For applications where the load carrying capacity of ball bearings is insufficient, spherical roller bearings with the same alignment performance should be used instead. When choosing exactly which bearing to use, you should consider the following factors.
1.Allowable space: that allows the installation of bearing appearance parameters.
2. Rotational accuracy: general selection are available G-class precision bearings.
3. Bearing rigidity: general roller bearing rigidity is greater than the ball bearing, improve the rigidity of the bearing can be by preload, but must be appropriate.
4. Load size and direction: both radial and axial joint load, while there is also a large shaft or shell deformation and installation of poor neutrality, can choose spherical ball bearings or spherical roller bearings.
5.Bearing working speed: Spherical roller bearings for heavy load medium speed, spherical ball bearings for light load high speed.
6.Mounting and dismantling: When dismantling frequently, the inner ring can be used for tapered hole with tightening sleeve or withdrawal sleeve of spherical roller bearings or spherical ball bearings.
7.Friction torque: Generally speaking, bearing low friction torque, should try to use spherical ball bearings.

5. What is the basic structure of Self-aligning ball bearings?

Self-aligning ball bearing is a special structure of the sliding bearing, mainly has a cylindrical hole and tapered hole two kinds of structure, the cage material has a steel plate, synthetic resin, etc., its structure is simpler than the rolling bearing, mainly by an outer spherical inner ring and an inner

spherical outer ring, with automatic self-aligning, can compensate for different heart and shaft deflection caused by Error, but its inner and outer ring relative tilt shall not exceed 3 degrees. Self-aligning ball bearing can bear a large load, according to its different types and structure, can bear radial load, axial load or radial, axial at the same time the combined load. Spherical ball bearing is generally used for lower speed swing movement (i.e. angular movement), because the sliding surface is spherical, also in a certain angle range for tilting movement (i.e. spherical movement), in the support shaft and shaft shell hole different heart degree is large, still can work normally.

6.Why self-aligning ball bearing are used in agriculture?

Spherical ball bearing, its outer ring for the spherical raceway and inner ring for the double raceway, this type of bearing has automatic self-aligning performance. Therefore, when the bearing bearing load bending or due to processing and installation errors caused by the inner ring axis relative to the outer ring axis tilt, but still can ensure the normal operation of machinery. Spherical ball bearings are mainly used to bear radial load, but also in bearing radial load while bearing a certain amount of axial load, but can not bear pure axial load.

Self-aligning ball bearings than other types of bearings produce less friction, which makes them able to run at higher speeds without generating excessive heat, therefore, spherical ball bearings are more suitable for low and medium loads.

7. What is the difference between angular contact ball bearings and spherical ball bearings?

Angular contact ball bearing can bear radial load and axial load at the same time, and can work at higher speed, the larger the contact angle, the higher the axial load carrying capacity. Because of its inner and outer ring raceway can have relative displacement in the horizontal axis, so it can simultaneously withstand radial load and axial load - combined load (single row angular contact ball bearing can only withstand single direction axial load, so generally are often used in pairs installation).

Self-aligning ball bearing because of the outer ring raceway surface is spherical, has the performance of adjusting the heart, so can automatically adjust the shaft or shell of the deflection or different heart caused by the axis incorrect tapered hole bearing by using fasteners can be conveniently installed in the shaft steel plate stamping keep frame inner wheel and steel ball can be tilted freely to the outer wheel, therefore, a degree of assembly error (not to the heart) or axis of the heart radial curve can be automatically adjusted without damage to the bearing. As to whether it is possible to swap! It depends on the specific use, taking into account the speed, load, contact angle and other factors.

8. What is the difference between spherical ball bearings and deep groove ball bearings?

Self-aligning ball bearing's outer ring raceway is a spherical surface centered on the center of the bearing, so when the inner ring and outer ring are staggered by a certain angle, the rollers still roll on the spherical surface, then the distance between the rollers and the center of the bearing will not change, and there will be no jamming or wear, that's why it is called spherical bearing. That's why it is called spherical bearing.

Spherical bearings can be applied to the ends of longer shafts, suitable for dodging pivot points and bending stiffness of the shaft. And the outer ring of deep groove ball bearing rolling is not spherical, so it can not be self-aligning, then he is suitable for stiffness of the short shaft.