满装圆柱滚子轴承

Full complement cylindrical roller bearing

Ⅰ.特性

无外圈的满装圆柱滚子轴承

由实体内圈和挡边引导的圆柱滚子组成。内圈具有两个刚性挡边。

由于这类轴承具有尽可能多数量的滚动体，因此它们具有极高的径向承载能力，极高的刚性，适用于特别紧凑的结构设计。然而受运动学条件的限制，这类轴承无法达到带保持架的圆柱滚子轴承那样高的极限转速。

该轴承有单列和双列定位轴承设计

轴承不仅可承受高径向力，同样可承受双向轴向力。

轴承按照开式设计供货。轴承未作预润滑，可进行油润滑或脂润滑。

滚动体由塑料套保护，以防运输过程中的损坏和丢失。

Ⅰ. Characteristic

Full complement cylindrical roller bearing without outer ring

It consists of a cylindrical roller guided by a solid inner ring and a rib. The inner ring has two rigid ribs. Due to the fact that these bearings have as many rolling elements as possible, they have a very high radial load carrying capacity and a high rigidity for a particularly compact design. However, due to kinematic conditions, such bearings cannot reach the high limit speeds of cylindrical roller bearings with cages.

The bearing has single row and double row positioning bearing design

Bearings can withstand high radial forces as well as two-way axial forces.

The bearings are supplied in an open design. The bearings are not pre-lubricated and can be oil or grease lubricated.

The rolling elements are protected by a plastic sleeve to prevent damage and loss during transport.

Ⅱ.载荷

最小径向载荷

对于连续运转工况，最小径向载荷 Fr min必须满足Fr min=Cor/60。

轴向定位

为了防止轴承套圈出现侧向位移，必须通过合适的配合方式将其定位。

相邻的挡肩必须具有足够的高度并且垂直于轴承的轴线。

轴承配合面到相邻挡肩的过渡圆角须符合 DIN 5418，退刀槽须符合 DIN 509。

行星轮的轴向引导

圆柱滚子轴承可实现行星轮的轴向引导。

这可通过布置在滚动体两侧的轴向垫圈和止动环实现。作为备选方案，可以使用 L 型挡圈 。

Ⅱ. Load

Minimum radial load

For continuous operating conditions, the minimum radial load Fr min must satisfy Fr min=Cor/60.

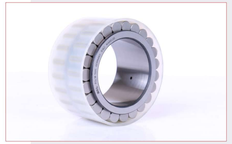
Axial positioning

In order to prevent lateral movement of the bearing ring, it must be positioned with appropriate fit. Adjacent shoulders must have sufficient height and be perpendicular to the axis of the bearing. The transition fillet of the bearing mating face to the adjacent shoulder shall comply with DIN 5418 and the undercut shall comply with DIN 509.

Axial guidance of planetary gears

Cylindrical roller bearings enable axial guidance of the planet gears.

This can be achieved by axial washers and snap rings arranged on both sides of the rolling bodies. Alternatively, an L-shaped retaining ring can be used.



Ⅲ.公差等级

公差等级符合DIN 620 ，默认P6级，可根据客户要求提供符合P5、P4公差等级的轴承

Ⅲ. Tolerance class

Tolerance class according to DIN 620. P6 class, P5, P4 tolerance class bearing available according to customer requirements.

Ⅳ.型号

可提供轴承型号范围

单列

RSL183004-RSL183040

RSL182204-RSL182240

RSL182305-RSL182330

双列

RSL185004-RSL185040

轴向垫圈

RSL1850/3004-RSL1850/3040

Ⅳ. Model

Available bearing range

Single row

RSL183004-RSL183040

RSL182204-RSL182240

RSL182305-RSL182330

Double row

RSL185004-RSL185040

Axial washer

RSL1850/3004-RSL1850/3040

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可以满足各种设计要求。

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可以在全球范围内提供行星轮轴承布置的轴承选型和轴承布置设计的咨询服务。

We have a lot of special solutions,

Can meet a variety of design requirements.

Application Engineer and SKL Engineering Services,

Consulting services for bearing selection and bearing arrangement design for planetary wheel bearing arrangements are available worldwide.

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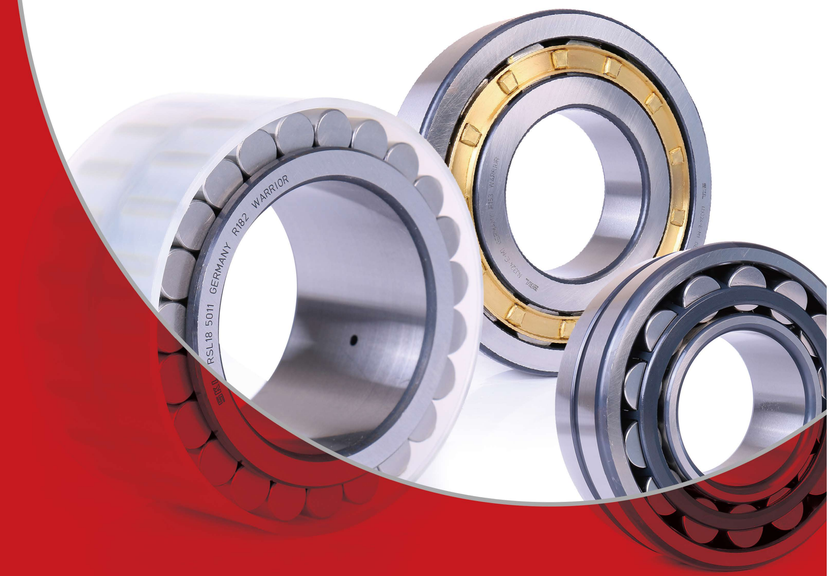
精密可控传动轴承单元

THE DEVELOPMENT TREND OF MODERN GEARBOX



现代齿轮箱的发展趋势

Foreword

工业齿轮箱的设计趋势：

外观整体结构——更小，

内部组合结构——更紧凑，

齿轮箱功率水平——更高。

因此，在非常狭小的空间内提升功率密度对所使用的轴承也提出了更高的要求。

在一些应用中，特殊情况下行星齿轮箱承受的载荷甚至达到了它们的物理极限。

对于近乎苛刻的应用要求，轴承布置不仅要减小设计空间，还要降低运转噪音，同时具有低摩擦、高可靠性、长寿命、易于安装的特点，这样的轴承解决方案才是现代齿轮箱发展的趋势。

Industrial gearbox design trends:

The overall structure of the appearance – smaller,

Internal combination structure – more compact,

Gearbox power level – higher.

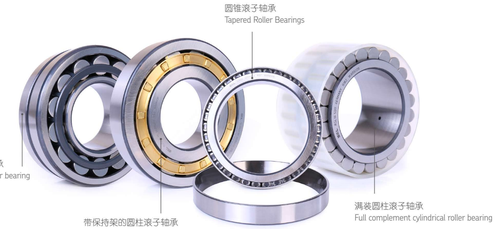
Therefore, increasing the power density in a very small space places higher demands on the bearings used.

In some applications, the planetary gearboxes under special conditions are even subjected to their physical limits.

For almost demanding applications, the bearing arrangement not only reduces the design space, but also reduces the running noise. At the same time, it has the characteristics of low friction, high reliability, long life and easy installation, this bearing solution is the trend of modern gearbox development.

齿轮箱主要轴承细分

Subdivision of bearings for gearboxes



带保持架的圆柱滚子轴承

Cylindrical roller bearing with cage

Ⅰ.特性

带保持架的圆柱滚子轴承

轴承由实体内圈和圆柱滚子保持架组件构成。外圈两侧带有刚性挡边或者没有挡边内圈具有一个或两个刚性挡边或者没有挡边。

保持架阻止滚动体滚动过程中的相互接触。

带保持架的轴承具有很高的刚性，可承受高径向载荷，与滑装设计相比，可适合于更高的转速。

它们有些采用提高性能的滚动体，因此可用于设计极高的承载能力。

该轴承为单列定位轴承

轴承不仅可承受高径向力，同样可承受双向轴向力。

轴承提供开式设计。该轴承未作预润滑，可以从轴承端部进行油润滑或脂润滑。

此轴承可以设计为无外圈，以适合行星齿轮箱使用。

Ⅰ. Characteristic

Cylindrical roller bearing with cage

The bearing consists of a solid inner ring and a cylindrical roller cage assembly. Rigid ribs on both sides of the outer ring or no ribs

The inner ring has one or two rigid ribs or no ribs.

The cage prevents mutual contact during the rolling of the rolling elements.

Bearings with cages are highly rigid and can withstand high radial loads and are suitable for higher speeds than full-fit designs

Some of them use rolling elements that improve performance, so they can be used to design extremely high load carrying capacity.

The bearing is a single row locating bearing

Bearings can withstand high radial forces as well as two-way axial forces.

The bearings are available in an open design. The bearing is not pre-lubricated and can be oil lubricated or grease lubricated from the end of the bearing.

This bearing can be designed without an outer ring to fit the planetary gearbox.

Ⅱ.载荷

最小径向载荷

对于连续运转工况，最小径向载荷 Fr min必须满足Fr min=Cor/60。

轴向定位

为了防止轴承套圈出现倒向位移，必须通过适形配合的方式将其定位。

相邻的挡肩必须具有足够的高度并且垂直于轴承的轴线。

轴承配合面到相邻挡肩的过渡圆角须符合 DIN 5418，退刀槽须符合 DIN 509。

行星轮的轴向引导

圆柱滚子轴承可实现行星轮的轴向引导。

这可通过布置在滚动体两侧的垫圈和止动环实现。作为备选方案，可以使用 L 型挡圈的轴承。

Ⅱ. Load

Minimum radial load

For continuous operation, the minimum radial load Fr min must satisfy Fr min=Cor/60.

Axial positioning

In order to prevent lateral displacement of the bearing ring, it must be positioned in a conformable manner. Adjacent shoulders must have sufficient height and be perpendicular to the axis of the bearing.

The transition fillet of the bearing mating face to the adjacent shoulder shall comply with DIN 5418 and the undercut shall comply with DIN 509.

Axial guidance of planetary gears

Cylindrical roller bearings enable axial guidance of the planet wheels.

This can be achieved by means of washers and snap rings arranged on both sides of the rolling bodies. As an alternative, bearings with L-rings can be used.

Ⅲ.公差等级

公差等级符合DIN 620 ，默认P6级，可根据客户要求提供符合P5、P4公差等级的轴承

Ⅲ. Tolerance class

Tolerance class according to DIN 620, P6 class, P5, P4 tolerance class bearing available according to customer requirements.

调心滚子轴承

Spherical roller bearing

Ⅰ.特性

调心滚子轴承是双列不可分离轴承，包括有球面滚道的实体外圈、圆柱孔实体内圈和带保持架的鼓形滚子。

内圈为圆柱孔。对称的鼓形滚子可以在外圈球面滚道里自由调整，这样可以补偿不对中和出现的挠曲。

调心滚子轴承也可以用在行星齿轮中，特别是用在需要经济的解决方案和低转速的场合。

调心滚子轴承可以采用油润滑或脂润滑。

Ⅰ. Characteristic

Spherical roller bearings are double row non-separable bearings, including a solid outer ring with a spherical raceway, a cylindrical bore inner ring and a drum roller with a cage.

The inner ring is a cylindrical hole. Symmetrical drum rollers can be freely adjusted in the outer spherical raceway to compensate for misalignment and tooth profile deviations.

Spherical roller bearings can also be used in planetary gears, especially where economical solutions and low speeds are required.

Spherical roller bearings can be oil or grease lubricated.

Ⅱ.径向和轴向承载能力

调心滚子轴承可以承受双向轴向力和大的径向力。

它们为高承载能力而设计，因为它们拥有尽可能大而且多的鼓形滚子，调心滚子轴承也可用于极重的载荷。

Ⅱ. Radial and axial load carrying capacity

Spherical roller bearings can withstand two-way axial forces and large radial forces.

They are designed for high load carrying capacity because they have as many drum rollers as possible and large, and spherical roller bearings can also be used for extremely heavy loads.

Ⅲ.最小径向载荷

为了实现无滑动运转，最小径向载荷 Fr min必须满足

Pr/Cr＞0.02 。

Ⅲ. Minimum radial load

In order to achieve no sliding operation, the minimum radial load F r min must satisfy P/C r＞0 . 02.

Ⅳ.公差等级

公差等级符合DIN 620，默认普通级，可根据客户要求提供符合P6、P5公差等级的轴承

Ⅳ. Tolerance class

Tolerance class according to DIN 620, normally P0 class, P6, P5 tolerance class bearing available according to customer requirements.

圆锥滚子轴承

Tapered Roller Bearings

Ⅰ.特性

圆锥滚子轴承由具有锥形滚道的实体内圈和外圈及带冲压钢保持架的锥形滚动体组件组成。这类轴承不是自保持的轴承。

因此，带有滚子和保持架的内圈可以和外圈分开安装。

该轴承为开式设计。可以采用油润滑或脂润滑。

Ⅱ.径向和轴向承载能力

圆锥滚子轴承可以承受单向的轴向力和大的径向力。

通常他们可以相对于另外一个对称布置的轴承在轴向方向上进行调整。

Ⅲ.配对轴承

这些轴承成对按照 O 型或 X 型布置。可以承受很大的双向的轴向力和倾矩。

O 型布置或 X 型布置的圆锥滚子轴承的优点是可以根据需求调整为零间隙。

例如：这种解决方案被应用于风力发电机的齿轮箱上。

Ⅳ.最小径向载荷

为了实现无滑动运转，轴承必须承受一个径向方向的最小载荷Fr min 。

在连续运转的情况下，带保持架的圆锥滚子轴承必须承受一个满足 P/Cr＞0.02 要求的最小径向载荷。

Ⅴ.公差等级

公差等级符合DIN 620，默认P6X级，可根据客户要求提供符合P5、P4公差等级的轴承

Ⅰ. Characteristic

Tapered roller bearings consist of a solid inner and outer ring with tapered raceways and a tapered rolling element assembly with a stamped steel cage. These bearings are not self-retaining bearings.

Therefore, the inner ring with the roller and the cage can be mounted separately from the outer ring.

The bearing is an open design. Oil or grease lubrication can be used.

Ⅱ. Radial and axial load carrying capacity

Tapered roller bearings can withstand unidirectional axial forces and large radial forces.

Usually they can be adjusted in the axial direction relative to another symmetrically arranged bearing.

Ⅲ. Paired bearing

These bearings are arranged in pairs in an O or X configuration. Can withstand large bidirectional axial forces and bending moments.

The advantage of tapered roller bearings in O- or X-arrangement is that zero clearance can be adjusted as required.

For example, this solution is applied to the gearbox of a wind turbine.

Ⅳ. Minimum radial load

In order to achieve no sliding operation, the bearing must withstand a radial load with a minimum load F r min .

In the case of continuous operation, tapered roller bearings with cages must withstand a minimum radial load that meets the requirements of P/C r＞0.02.

Ⅴ. Tolerance class

Tolerance class according to DIN 620, P6X class, P5, P4 tolerance class bearing available according to customer requirements.

齿轮箱细分

Gearbox subdivision

螺旋齿/斜齿齿轮箱
Spiral/helical gearbox

蜗轮齿轮箱
Worm gearbox

人字齿齿轮箱
Herringbone gearbox

行星齿轮箱
Planetary gearbox

直齿/斜齿齿轮箱
Spur/helical gearbox

其它定制
Other

齿轮箱轴承应用

Gearbox bearing applications

齿轮可做成直齿、斜齿和人字齿。

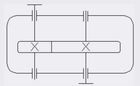
根据传动比及传动布置形式可分为展开式、分流式和同轴式。

圆柱齿轮箱在所有减速器齿轮箱中应用最广。

The gears can be made up of straight teeth, helical teeth and herringbone teeth.

According to the transmission ratio and transmission arrangement, it can be divided into expansion type, split type and coaxial type.

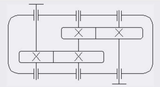
Cylindrical gearboxes are the most widely used in all gearboxes.



单级减速器 Single stage reduce

传动方向不变
传动比 5（直齿轮）
传动比 10（斜齿轮、人字齿轮）

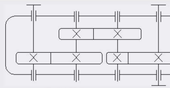
The direction of the drive is unchanged
Transmission ratio 5 (spur gear)
Transmission ratio 10



二级减速器 Secondary reducer

传动方向不变
传动比介于 3 — 40 之间

The direction of the drive is unchanged
Transmission ratio between 3 and 40.



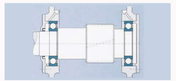
三级减速器 Three-stage reducer

传动方向不变
传动比介于 40 — 400 之间

The direction of the drive is unchanged
Transmission ratio between 40 and 400

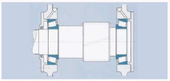
1.DGBB+DGBB
点接触，摩擦小
适合高速
一端固定，一端浮动
常用轴承：62、63系列
配合公差：
与轴配合：k6、m6
与孔配合：J7、H7(固定)/G7、F7(浮动)

1.DGBB+DGBB
Point contact, small friction
Suitable for high speed
Fixed at one end and floating at one end
Commonly used bearings: 62, 63 series
Fit tolerance:
Cooperate with the shaft: k6, m6
Cooperate with the hole: J7, H7 (fixed)
G7, F7 (floating)



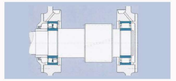
2.TRB+TRB
可承受较大轴向力
纯滚动、摩擦小
成本高
箱体刚性差时，附加轴向力
易导致箱体处变形
常用轴承：320、322系列
配合公差：
与轴配合：k5、m5、n6、p6
与孔配合：J7、H7

2.TRB+TRB
Can withstand large axial forces
Pure rolling, small friction
high cost
Additional axial force when the rigidity of the box is poor
Easy to cause deformation at the box
Commonly used bearings: 320, 322 series
Fit tolerance:
Cooperate with the shaft: k5, m5, n6, p6
Cooperate with the hole: J7, H7



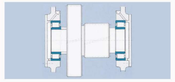
3.SRB+CRB
可承受较大径向载荷
常用轴承：232、223、NU、NJ2系列
配合公差：
与轴配合：k5、m5、n6、p6
与孔配合：J7、H7

3.SRB+CRB
Can withstand large radial loads
Commonly used bearings: 232, 223, NU, NJ2 series
Fit tolerance:
Cooperate with the shaft: k5, m5, n6, p6
Cooperate with the hole: J7, H7



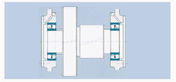
4.CRB+CRB
承受较大的径向载荷
可承受轴向载荷小
适用于直齿轮/人字齿
常用轴承：NJ2、NJ22、NJ23系列
配合公差：
与轴配合：k5、m5、n6、p6
与孔配合：J7、H7

4.CRB+CRB
Withstand large radial loads
Can withstand small axial loads
Suitable for spur gear / herringbone
Commonly used bearings: NJ2, NJ22, NJ23 series
Fit tolerance:
Cooperate with the shaft: k5, m5, n6, p6
Cooperate with the hole: J7, H7



5.SRB+SRB
承受较大的径向载荷
抗偏心能力强
常见于重载齿轮箱
常用轴承：222、223系列
配合公差：
与轴配合：k5、m5、n6、p6
与孔配合：J7、H7(固定)/G7、F7(浮动)

5.SRB+SRB
Withstand large radial loads
Strong anti-eccentricity
Common in heavy duty gearboxes
Commonly used bearings: 222, 223 series
Fit tolerance:
Cooperate with the shaft: k5, m5, n6, p6
Cooperate with the hole: J7, H7 (fixed)G7, F7 (floating)



牵引用齿轮箱改进案例

Improved case for gearbox used as traction

该牵引驱动装置有一个多级的行星齿轮箱。

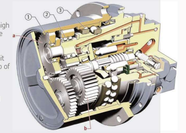
第1 级行星传动为高速轮载。第2 级行星传动为低速重载。

各级行星齿轮将力传递到齿圈，也就是整个机器的轮毂。

牵引驱动装置经常长时间运行在极端恶劣的工况中。

尽管如此，它们还是要求有很高的运行安全性和极少的维护。

The traction drive has a multi-stage planetary gearbox.
The first stage planetary transmission is high speed and light load, and the second stage planetary transmission is low speed and heavy load.
The planetary gears of each stage transmit the force to the ring gear, which is the hub of the entire machine.
Traction drives often operate in extreme conditions for extended periods of time.
Despite this, they require high operational safety and minimal maintenance.



空间局限性是这种牵引驱动面临的主要考验之一

因此，所有行星齿轮都是由无外圈的滴装圆柱滚子轴承来支承。即所有轴承滚动体都是直接在行星齿轮的内孔上运转。这样，轴承只需要很小的空装空间。

Space limitations are one of the main challenges faced by this traction drive

Therefore, almost all planetary gears are supported by full complement cylindrical roller bearings without outer rings. That is, all bearing rolling elements run directly on the inner bore of the planetary gear. In this way, the bearing requires only a small installation space.

滴装滚子设计可以保证轴承有很高的承载能力

在行星齿轮中，轴承依靠止动环在轴向定位。为了有效的降低行星销的边缘应力。在轴承内圈的一侧有一个较大的圆角。

一对带保持架的小滚锥角接触球轴承组成的主轴承可以作为一个牢靠稳定的支承。在极重载条件下，也可以使用预紧的角接触滚子轴承或者0 型布置的圆锥滚子轴承。

无滑脱运行可以提高齿轮的承载能力并可以确保低噪音、稳定的运行。

A—级行星

B-二级行星

Fully loaded roller design ensures high bearing capacity

In planetary gears, the bearings are positioned axially by means of a snap ring. In order to effectively reduce the edge stress of the planet pin, there is a large rounded corner on one side of the inner ring of the bearing.

A pair of small clearance angular contact ball bearings with cages can be used as a strong and stable support. Preloaded angular contact roller bearings or O-shaped tapered roller bearings can also be used under extremely heavy loads.

No play operation improves the load carrying capacity of the tooth and ensures low noise and stable operation

A: Level 1 planet

B: secondary planet

轴承在牵引驱动中的位置

① 无外圈的单列满装圆柱滚子轴承RN （特殊设计）

② 双列满装圆柱滚子轴承RNN带2个轴向垫圈和1个止动环 (特殊设计)

③ 带保持架的双列小滚锥角接触球轴承

备选方案：型0 型布置的两个302、 322 系列圆锥滚子轴承

Bearing position in the traction drive

1 single row full complement cylindrical roller bearing without outer ring RN (special design)

2 double row full complement cylindrical roller bearings RNN with 2 axial washers and 1 snap ring (special design)

3 double row small clearance angular contact ball bearings with cage
Alternative: Two 302, 322 series tapered roller bearings in O-shape

与客户共同改进方案

Work with customers to improve the program

整合式轴承：不带外圈的warrior 圆柱滚子轴承

这种轴承的滚道整合到行星齿轮内，内圈和滚动体黑化。

- 承载能力高
- 运转安全性高
- 径向截面尺寸小
- 受限内部游隙实现轴承内部载荷的最佳分布

Integrated bearing: warrior cylindrical roller bearing without outer ring

The raceway of such a bearing is integrated into the planetary gear, and the inner ring and the rolling body are blackened.

- High carrying capacity
- High operational safety
- Small radial section size
- Limited internal clearance for optimal distribution of bearing internal loads

替代方案：SKL高承载能力圆柱滚子轴承

基于对保持架的特殊洗练型设计，

高承载能力圆柱滚子轴承集合了滴装轴承和带保持架轴承的优点与具有标准保持架的轴承相比，这种轴承的额定载荷能够得到大幅的提升。

- 摩擦低
- 额定载荷高（基于滚动体数量增加）
- 轴承装配简单（基于自保持功能的保持架）
- 高刚度，轻量化设计
- 优化润滑剂流动
- 改进的启动性能（增加氧化层）

Alternative:
SKL high load capacity cylindrical roller bearing

Based on a special streamlined design of the cage,

High load capacity cylindrical roller bearings combine the advantages of full complement bearings with cage bearings.

The rated load of this bearing can be greatly improved compared to bearings with standard cages.

- Low friction
- High rated load (based on the increase in the number of rolling elements)
- Simple bearing assembly (holding cage based on self-holding function)
- High rigidity, lightweight design
- Optimized lubricant flow
- Improved start-up performance (increased oxide layer)