



回转支承维护手册

SLEWING RING MANUAL

安装之前请仔细阅读所有指导书和手册

Please read all instructions and manuals carefully before installation

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Cone Drive by Timken

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总则:

- 购买者负责提供安全防护措施及所有设备的正确安装。
- 安装回转支承前, 请阅读此手册。只有在严格遵守指导规则的条件下, 才能保证其工作特性。
- 此手册包含回转支承的正确安装和维护所需信息。
- 下列所有工作步骤都需要专业人员进行操作。
- 如有技术问题, 请立即与本公司售后服务联系。
- 下列文件指导用户如何正确安装和维护回转支承. 此版本将取代早期的所有版本. 最终版本将在我们公司的网
址主页发布, 用户可以登陆 www.conedrive.com.cn 进行下载。

General:

- The purchasers are responsible for providing safety precautions and correct installation of all equipment.
- Please read this manual carefully before installation. The working characteristics of the slewing rings can only be ensured when complying with the manual.
- This manual contains the information required for correct installation and maintenance of the slewing rings.
- All the following steps need to be operated by technical personnels.
- Please don't hesitate to contact service engineers for any further assistance.
- The documents guide purchasers on how to install and maintain the slewing ring correctly. The latest version is published on our homepage and can be downloaded from www.conedrive.com.cn. Please always check that you are working with the latest revision.

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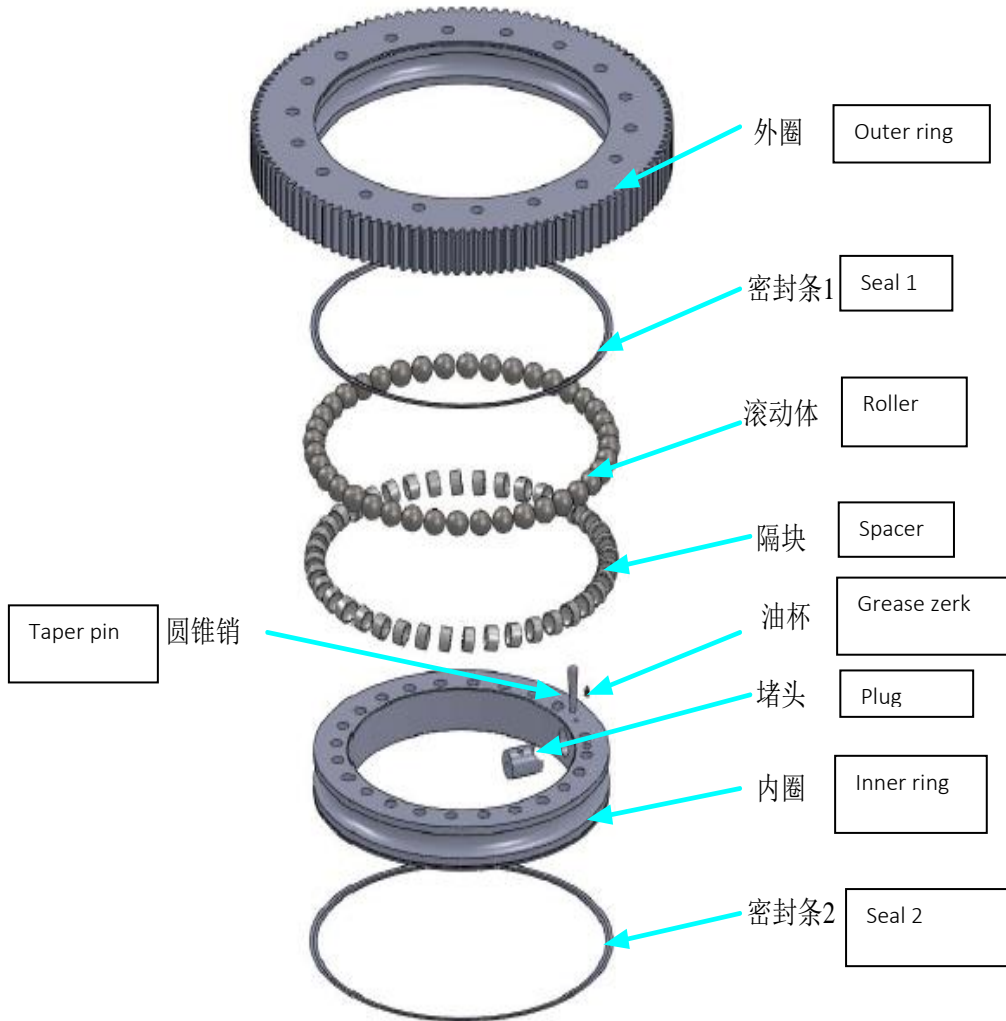
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回转支承结构简图

The Structure Sketch of Slewing Bearing



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1 运输、搬运与贮藏 Transport、Handling & Storage Provisions

1.1 运输与搬运 Transport、Handling

运输时请保持回转支承包装箱按规定的方向放置，做到轻取轻放，避免碰撞；确保回转支承在运输过程中水平放置，并固定防止滑动；回转支承的内外圈一般都有螺纹孔，吊装时宜采用吊装螺钉水平吊运。 **Please keep the slewing bearing in prescribed position and avoid any collision. Ensure that the slewing bearing is placed horizontally during transport and fixed to prevent sliding. Use the thread holes of the outer ring or inner ring to fix bolts for safe hoisting, handling and placement.**

1.2 贮藏 Storage

贮藏时请保持回转支承包装箱按规定的方向放置，存放在密闭的房间，注意防潮；

回转支承表面涂有防锈油，一般可维持 5 个月，若需更长时间存放，应对外表面重新进行防锈处理； **Store only in a prescribed position and in closed rooms, keep it away from getting wet, the surface corrosion protection holds for approx. 5 months in closed packaging, longer period storage requires special protective measures.**

2 安装 Installation

2.1 安装前准备事项 Preparation

(1) 去除包装纸时要避免损坏回转支承的密封条； **When removing the wrapping paper, avoid damaging the seals of the slewing bearing.**

(2) 检查回转支承上的铭牌是否与所选型号一致； **Check that the nameplate on the slewing bearing whether it is consistent with the selected model.**

(3) 检查回转支承是否有物理损坏； **Check the slewing bearing for physical damage.**

(4) 安装前应去除回转支承安装面的油脂； **Grease should be removed from the mounting surface of slewing bearing before installation.**

(5) 请按以下说明清洗回转支承安装面的防锈油。 **Please clean the anti-rust oil on the mounting surface of the slewing bearing according to the following instructions.**

- 用清洗液（如：柴油，汽油等）清洗安装表面； **Clean mounting surfaces with a cleaning solution (e.g., diesel, gasoline, etc.).**

- 清洗液不能流入密封圈或滚道内； **Cleaning fluid cannot flow into the seals or raceway.**

安装平面必须清洁、平整，清理安装面上的杂质，（如：铁屑，毛刺，油漆，焊渣等）；

The mounting surface must be clean and smooth, and remove impurities on the installation surface (such as iron scrap, burr, paint, welding slag, etc.);

安装支架应具有足够的刚度，以防止回转支承变形导致其不能正常工作；

The mounting bracket shall have sufficient stiffness to prevent the slewing bearing from working abnormally due to deformation.

安装支架的安装平面度和允许的挠度必须满足以下表格要求：

The installation flatness and allowable deflection of the mounting bracket must meet the following table requirements:

表 2-1

滚道中心直径 (mm) Diameter of raceway	安装支架平面度 (mm) Flatness of mounting bracket	支架允许的最大挠度 (mm) Maximum allowable deflection of bracket
~1000	0.15	0.6
1000~1500	0.20	0.8
1500~2000	0.22	1.0
2000~2500	0.25	1.2
2500~4000	0.30	1.5

注: 表中数值为允许的最大值。 **Note: the values in the table are the maximum allowed.**

支承结构 **Slewing bearing structure**

- 为保证对所传递的载荷具有足够的刚度, 回转支承必须安装在经机加工过的支承基座上。这样就能保证应力的均匀分布, 避免运行时回转支承的变形。 **To ensure sufficient stiffness to the load transmitted, the slewing bearing must be mounted on a machined base. In this way, the uniform distribution of stress can be ensured and the deformation of the slewing bearing can be avoided.**

因此基座厚度不应低于下表中的数值: **Therefore the base thickness should not be lower than the following table:**

表 2-2

滚道平均直径 (mm) Average diameter of raceway	500	750	1000	1250	1500	2000	2500	3000
最小厚度 (mm) Minimum thickness	25	30	35	40	50	60	70	80

- 支承底座的刚度必须满足: 在最大载荷下, 轴向偏斜量不能超出下表中的值: **The stiffness of the slewing bearing base must meet the following requirements: under the maximum load, the amount of axial deflection should not exceed the values in the following table:**

表 2-3

滚道平均直径 (mm) Average diameter of raceway	500	750	1000	1250	1500	2000	2500	3000
最大轴向偏斜量 Maximum axial deflection	0.25	0.30	0.35	0.45	0.55	0.65	0.80	1.00

- 安装配合支座一般采用筒形结构。为使载荷均匀, 一般使用厚的圆形底座, 如下图所示: **Generally, the installation and matching slewing bearing adopt tubular structure. To ensure even load, a thick circular base is generally used, as shown in the figure below:**

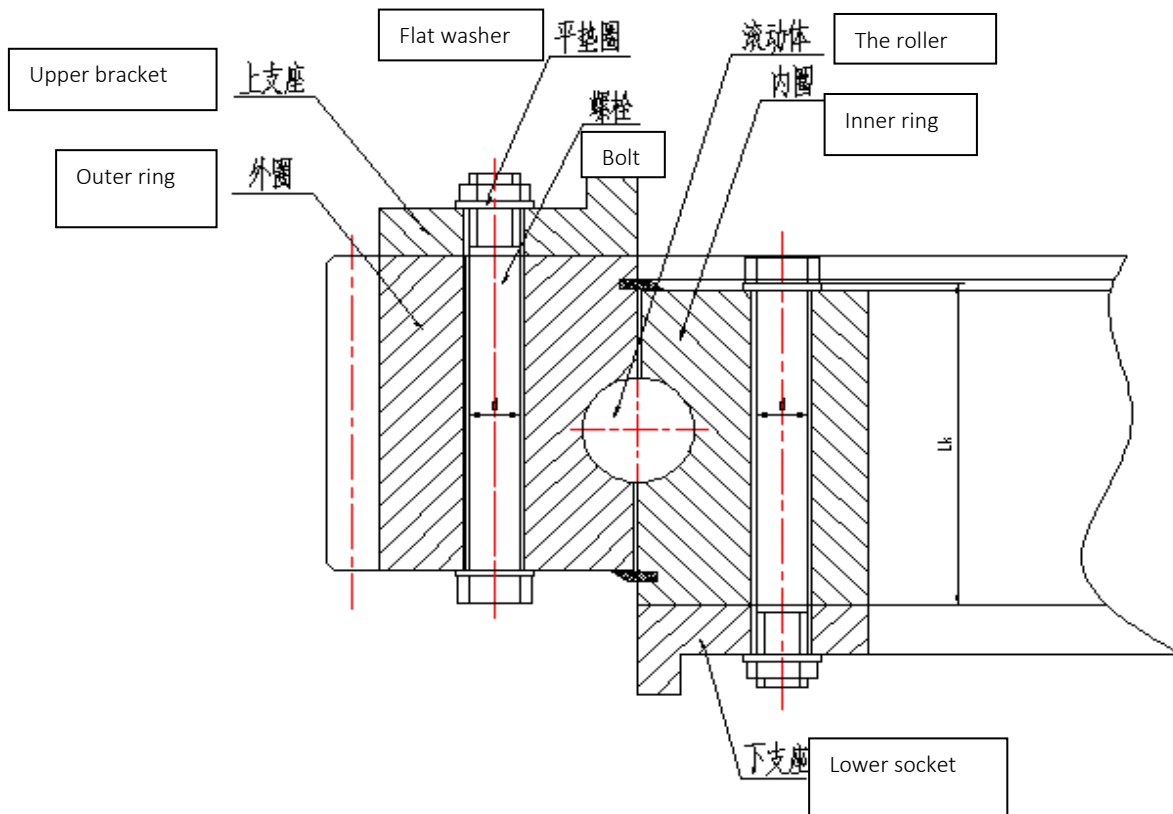


图 2-1

安装螺栓 Mounting bolt

- 请根据受力情况正确选用螺栓规格、型号及性能等级，其强度等级不得低于 8.8 级，螺母必须是相应螺栓的同等级别或更高级别。采用符合要求的平垫圈，不得使用弹簧垫圈；**Please choose the bolt specification, model and performance grade according to the stress condition, the strength grade shall not be lower than 8.8, and the nut shall be the same grade or higher grade of the corresponding bolt. Adopt the standard plain washer and do not use spring washer;**
- 螺栓夹紧长度 $L_k \geq 5d$ (d—螺栓直径); **Bolt clamping length $L_k \geq 5d$ (d—diameter of bolt)**
- 安装螺栓应有足够的预紧力，一般预紧力为螺栓屈服极限的 0.7 倍，表 2-4 中列出了可供参考的拧紧力矩。**The mounting bolt shall have sufficient preloading force, which is generally 0.7 times the yield limit of the bolt. The tightening torques for reference are listed in table 2-4.**

表 2-4

公制螺栓 Metric bolt			
螺栓规格 Type	拧紧力矩 Tightening torque (Nm)		
	8.8 级	10.9 级	12.9 级
M8	26±4	33±3	45±6
M10	52±7	72±6	90±10
M12	90±12	120±10	150±20
M16	225±35	305±25	380±50
M18	310±45	415±35	521±70

M20	410±50	600±50	750±100
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2.2 安装过程 Install process

(1) 将回转支承水平吊放在基座上, 回转支承的软带(外部标记"G"或堵塞孔处)应置于非负载区或者非经常负载区; Place the horizontal suspension of the slewing bearing on the base, and the soft belt of the slewing bearing (external mark "G" or plug hole) should be placed in the non-load area or the non-frequent load area;

(2) 用塞尺检查回转支承平面与安装平面之间是否有间隙, 若有间隙应重新进行机械加工, 若不方便加工可采用垫圈进行填充; Use the feeler to check whether there is a gap between the slewing bearing plane and the installation plane. If there is a gap, it should be machined again.

(3) 安装螺栓拧紧前, 应对齿轮径向跳动最大点处的啮合进行调整, 使齿侧间隙符合要求, 并在螺栓拧紧后在全部齿圈上进行一次齿侧间隙的检查; Before tightening the mounting bolts, the meshing of the maximum radial run-out point of the gear should be adjusted to make the tooth side clearance meet the requirements, and after tightening the bolts, the tooth side clearance should be checked on all gear rings.

拧紧螺栓时请遵守以下程序: Please follow the following procedures when tightening bolts:

- 在螺纹处添加螺纹紧固胶水; Add thread fastening glue at the thread;
- 预紧螺栓及垫圈应交叉拧紧, 从内圈或外圈开始, 将所有螺栓进行对角扭紧至 30% 拧紧力矩, 然后重复对角扭紧至 50% 拧紧力矩, 最后对角扭紧至 100% 拧紧力矩。The pre-tightening bolt and washer should be tightened crosswise, starting from the inner or outer ring, diagonally tighten all bolts to 30% tightening torque, then repeat diagonally tightening torque to 50%, and finally diagonally tighten torque to 100%.

装机后的调试检测 Debugging and testing after installation

- 装机后应对回转支承设备进行清理; 缓慢旋转回转支承几圈, 仔细检查其运转是否顺畅, 有无异响以及冲击等。The slewing bearing equipment should be cleaned after installation. Slowly rotate the slewing bearing for a few cycles, carefully check whether its operation is smooth, no noise and impact.

3 维护、检查及润滑 Maintenance、Checks & Lubrication

3.1 维护、检查 Maintenance、Checks

- 应经常清除齿面、回转支承及周围的杂物; The tooth surface, slewing bearing and surrounding debris should be often removed;
- 初次装配后使用 100 小时左右, 应检查一下螺栓预紧力, 重新拧紧螺栓至规定的拧紧力矩; 这项检查需每年进行一次。螺栓松动后, 应立即更换所有螺栓、螺母和垫圈; After the initial assembly is used for about 100 hours, the pre-tightening force of bolts should be checked, and the bolts should be retightened to the specified tightening torque; The examination should be carried out annually. Replace all bolts, nuts and washers immediately after the bolts loosen;
- 回转支承设备使用过程中应观察其运行情况, 若发现噪音、冲击及振动应及时停机检查, 排除故障; The running condition of the slewing bearing equipment should be observed during use. If noise, shock and vibration are found, the equipment should be shut down in time for inspection and troubleshooting.
- 防止水直接冲刷回转支承装置以及硬物进入齿轮啮合区; Prevent water from directly washing slewing bearing devices and hard objects into gear mesh area;
- 检查密封情况是否良好, 密封圈有无过度拉伸或破损。Check if the seal is in good condition and the seal is overstretched or damaged.

3.2 回转支承润滑 Slewing bearing lubrication

润滑脂的选择 Choice of grease

适当的润滑对滚道和齿轮的耐久性而言是必须的, 运转工况, 如: 负载、温度、速度、振动等决定了润滑剂的选择。Proper lubrication is necessary for the durability of raceways and gears. Operating conditions, such as load, temperature, speed, vibration, etc., determine the choice of lubricant.

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正常情况下推荐使用的润滑脂见下表: **The recommended grease under normal conditions is shown in the following table:**

表 3-1

推荐润滑脂名称 Recommended grease	长城 7029D 润滑脂 Sinopec 7029D
适用温度范围 Ambient Temperature (°C)	-40 ~ +180
颜色 Appearance visual	浅黄色 Light yellow
稠化剂类型 Type of thickener	锂基润滑脂 Lithium base grease
40 °C 运动粘度 (cSt) Kinematic viscosity of 40 °C	44
闪点 Flashing point (°C)	> 200
熔化点 Fusing point (°C)	> 250

- 滚道 **Raceway**

产品出厂前已对回转支承滚道加注了润滑脂, 在使用过程中应对滚道定期加注润滑脂。 **Grease has been added to the raceway of slewing bearing before leaving the factory. Grease should be regularly added to the raceway during use.**

- 齿轮 **Gear**

润滑脂要完全覆盖小齿轮和带齿圈的齿面。 **The grease shall completely cover the tooth surfaces of the pinion and ring teeth.**

- 润滑孔 **Grease hole**

出厂时, 为了防止异物进入润滑孔内, 通常用螺钉堵住润滑孔, 在给回转支承添加润滑脂时应先取下。 **In order to prevent foreign matter from entering into the lubrication hole, screw is usually used to block the lubrication hole when adding grease to the slewing bearing.**

- 润滑脂添加方式 **Grease adding mode**

逐一向油杯中注入润滑脂, 每次注入润滑脂必须将滚道内注满, 直至从密封处渗出。注润滑脂时, 慢慢转动回转支承, 使润滑脂填充均匀。 **Grease is injected into the oil cup one by one. Each time the grease is injected, the raceway must be filled until it oozes from the sealing place. When filling grease, slowly rotate the slewing bearing to make the grease even.**

- 润滑周期 **Lubrication interval**

再润滑的时间主要取决于工况条件, 一般对于正常工况条件下应每运转 100 小时进行一次油脂的加注, 特殊工况下, 如湿度大、灰尘多、温度变化多以及连续工作时, 应缩短润滑周期。 **The relubrication time mainly depends on the working conditions. In general, under normal working conditions, grease shall be injected every 100 hours. Under special working conditions, such as high humidity, dust, temperature change and continuous work, the lubrication period shall be shortened.**

4 常见故障的排除 Troubleshooting of common faults

4.1 回转支承转动不灵活 **The slewing bearing is not flexible in rotation.**

科恩卓回转支承在出厂前都经过严格的检验和试运转, 均为合格产品。回转支承密封面存在预紧力, 转动时需克服摩擦力, 因此转动时需要一定的启动力矩是正常的。转动过程中出现卡滞现象可按照如下办法排除。 **Cone drive slewing bearing has passed strict inspection and rotation before leaving the factory. There is a preload on the sealing surface of slewing bearing, and the friction force must be overcome when rotating, so it is normal to require a certain starting torque when rotating. The phenomenon of stuck in the process of rotation can be eliminated according to the following methods.**

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表 4-1

故障类型 Fault type	故障原因分析 Failure cause analysis	解决措施 Solution
新购产品空转不灵活 Newly purchased product idling is not flexible.	回转支承购买放置时间较长（半年以上），或者存放环境温度较低，回转支承内油脂粘性变大导致运转不灵活。 The slewing bearing is bought and placed for a long time (more than half a year), or the storage environment temperature is low, the grease viscosity in the slewing bearing becomes greater, leading to the operation is not flexible.	加力后能正常运转且无其他异常可正常使用，但需要加注新油脂；若有异响，应检查在运输过程中有无损坏情况，并将信息反馈我公司处理。 It can work normally after adding the force and can be used normally without other abnormalities, but new grease needs to be added; if there is abnormal noise, we should check whether there is any damage in the process of transportation, and feedback the information to our company to deal with.
安装后运转不灵活 The operation is not flexible after installation	主机安装面与回转支承安装面配合不好，安装后回转支承的轴向间隙无法补偿回转支承的变形。 The installation surface of the main engine does not fit well with the installation surface of the slewing bearing, and the axial clearance of the slewing bearing after installation cannot compensate for the deformation of the slewing bearing	重新加工主机安装平面，使安装平面的平面度符合要求。 Reprocess the installation plane of the main engine to make the flatness of the installation plane meet the requirements.
	回转支承滚道变形，滚动体在滚道内运转困难（有时会伴有异响）。 Slewing bearing raceway deformation, the roller in the raceway difficult operation (sometimes accompanied by abnormal noise).	更换间隙较大的回转支承。 Replace the slewing bearing with large clearance.
	没有按要求调节齿侧间隙，导致大小齿轮啮合不良，或者大小齿轮内有异物。 Do not adjust the tooth backlash as required, resulting in poor meshing of the large and small gears, or there is foreign matter in the gear mesh.	重新按要求调整大小齿轮啮合齿侧间隙。 Readjust the tooth backlash the gear mesh as required.
使用过程中运转不灵活 The operation is not flexible during use.	大小齿轮内有异物。 There is foreign matter in big and small gears.	检查确保大小齿轮啮合部位没有异物存在。 Check to make sure there is no foreign matter in meshing parts of gears.
	未按手册规定的要求定期对回转支承加注润滑油脂，导致滚道非正常磨损。 Not according to the requirements specified in the manual regularly add lubricating grease to the slewing bearing, resulting in abnormal wear of the raceway.	按要求注满润滑油脂，若磨损严重应更换回转支承。 Fill with lubricating grease as required, and replace the slewing bearing if wear is serious.
	密封条破损，导致异物（铁屑、灰尘等）进入滚道内。 The seals are broken, causing foreign matter (iron scrap, dust, etc.) to enter the raceway.	更换密封带或采取有效的密封防护措施。 Replace the seals or take effective sealing measures.

	大小齿轮啮合异常，有异物或断齿。 Meshing of large and small gears is abnormal, with foreign body or broken teeth.	清除异物，有断齿时应更换回转支承。 Remove foreign bodies and replace the slewing bearing if there are broken teeth.
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4.2 异响 Abnormal sound

刚出厂的回转支承在空转时会发出钢球滚动的均匀响声，属于正常现象。在正常声响的同时伴有异常的，较大的声响成为异响，异响往往伴随转动困难。 **It is a normal phenomenon that the newly produced slewing bearing will produce even sound of steel ball rolling when it is idling. At the same time as the normal sound is abnormal, the larger sound becomes abnormal, which is often accompanied by rotation difficulties.**

表 4-2

故障类型 Fault type	故障原因分析 Failure cause analysis	解决措施 Solution
新购产品 异响 Newly purchased products are abnormal.	新购产品空转时轻微异响，转动数十圈后一般会消失。若没有消失则可能是运输过程中回转支承有轻微变形，但如果运转灵活，可放心安装使用，使用一段时间自然消失。 The newly purchased product is slightly abnormal when idling, and usually disappears after turning dozens of laps. If it doesn't disappear, it may be that the slewing bearing is slightly deformed in the transportation process, but if the operation is flexible, it can be safely installed and used, and it will disappear naturally after a period of time.	若响声较大或者使用 2~4 个月仍未消失，请与我公司联系。 If the noise is loud or does not disappear after 2~4 months, please contact us.
安装后异响 Abnormal sound after installation	主机安装面与回转支承面配合不好，导致安装后回转支承轴向间隙无法补偿回转支承的变形。 The installation surface of the main engine does not fit well with the slewing bearing surface, so the axial clearance of the slewing bearing after installation cannot compensate for the deformation of the slewing bearing.	重新加工主机安装平面，使安装平面的平面度符合要求。 Reprocess the installation plane of the main engine to make the flatness of the installation plane meet the requirements.
	回转支承滚道变形，滚动体在滚道内运转困难（有时会伴有异响）。 Slewing bearing raceway deformation, the rolling body in the raceway difficult operation (sometimes accompanied by abnormal noise).	更换间隙较大的回转支承。 Replace the slewing bearing with large clearance.
	没有按要求调节齿侧间隙，导致大小齿轮啮合不良。 Did not adjust tooth side clearance as required, resulting in poor meshing of large and small gears.	重新按要求调整大小齿轮啮合齿侧间隙。 Readjust the meshing tooth side clearance of the gear as required.
	大小齿轮内有异物。 There is foreign matter in big and small gears.	检查确保大小齿轮啮合部位没有异物存在。 Check to make sure there is no foreign matter in meshing parts of big and small gears.

使用过程中异响 Abnormal noise during use	<p>首先应确认是否为回转支承产生的异响，有些是其它结构产生的响声经常会被误认为是回转支承发出的响声。First of all, it should be confirmed whether it is the abnormal noise produced by the slewing bearing, some of the noise produced by other structures will often be mistaken for the noise produced by the slewing bearing.</p>	<p>可停止回转支承的运转，保持其它部件正常运转来判别。It can stop the operation of the slewing bearing and keep other parts in normal operation to judge.</p>
	<p>未按手册规定的要求定期对回转支承加注润滑油脂，导致滚道非正常磨损。Not according to the requirements specified in the manual regularly add lubricating grease to the slewing bearing, resulting in abnormal wear of the raceway.</p>	<p>按要求注满润滑油脂，若磨损严重应更换回转支承。Fill with lubricating grease as required, and replace the slewing bearing if wear is serious.</p>
	<p>密封条破损，导致异物（铁屑、灰尘等）进入滚道内。The sealing strip is broken, causing foreign matter (iron scrap, dust, etc.) to enter the raceway.</p>	<p>更换密封条或采取有效的密封防护措施。Replace the sealing belt or take effective sealing measures.</p>
	<p>安装螺栓松动，导致回转支承弹性变形，回转支承滚道变形，滚动体在滚道内运转困难，产生异响。The installation bolts are loose, which leads to the elastic deformation of the slewing bearing and the raceway deformation of the slewing bearing.</p>	<p>紧固螺栓，并定期检查螺栓的预紧力。Tighten the bolt and check the pretension of the bolt regularly.</p>

4.3 晃动 Wobble

回转支承加载后，其间隙大约为出厂空载间隙的3~5倍，在此范围内可正常使用。若超出此范围可按下面方法排除：After the slewing bearing is loaded, its clearance is about 3~5 times of the factory no-load clearance, which can be used normally in this range. If it is outside this range, it can be excluded as follows:

表 4-3

故障类型 Fault type	故障原因分析 Failure cause analysis	解决措施 Solution
安装后晃动过大 Too much shaking after installation	安装支座刚性不够，加载时产生变形导致整体晃动。The mounting support is not rigid enough, resulting in deformation during loading and overall shaking.	加强回转支承钢结构的强度。Strengthen the steel structure with slewing bearing.
使用过程中晃动过大	安装螺栓松动，造成回转支承工作时晃动。The mounting bolts are loose, causing the swing of the slewing bearing.	检查内外圈所有安装螺栓并按要求紧固。Check all mounting bolts on inner and outer rings and tighten as required.

Excessive shaking during use	长期超载作业导致滚道压溃，间隙过大。 Long-term overload operation leads to collapse of raceway and excessive clearance.	此时需更换回转支承。The slewing bearing should be replaced.
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4.4 断齿 Tooth break

回转支承出现断齿时应保护好现场，并通知我公司技术部进行分析处理。

The broken teeth of slewing bearing should protect the site, and inform our company's technical department for analysis.

表 4-4

故障类型 Fault type	故障原因分析 Failure cause analysis	解决措施 Solution
断齿 Tooth break	安装时齿轮齿侧间隙调节不当，未达要求，造成运转时两齿轮啮合不良而断齿。 Improper adjustment of gear tooth backlash during installation, not up to the requirements, resulting in the abnormal operation of two gears mesh and broken teeth.	重新按要求调整大小齿轮啮合齿侧间隙。 Readjust tooth backlash of the gear as required.
	大小齿轮安装时轴线不平行，大小齿轮啮合不良，造成断齿。The axis of the big and small gears are not parallel when they are installed.	应保证两齿轮轴线的平行。The axis of the two gears should be parallel.
	回转支承安装螺栓固定不紧，支承晃动变形造成齿轮啮合异常并出现断齿。The installation bolts of the slewing bearing are not fixed tightly, and the shaking deformation of the slewing bearing results in abnormal meshing and broken teeth.	应定期检查螺栓预紧力并拧紧螺栓。 Check the bolts preload and tighten the bolts regularly.
	回转支承与小齿轮啮合处有异物进入。 Foreign matter enters at the engagement of the slewing bearing and pinion gear.	经常检查，保证大小齿轮间干净无异物。 Check regularly to ensure clean and free of foreign matter between gears.
	违章操作：过载并高速旋转，主机冲撞障碍物等。Illegal operation: overload and high-speed rotation, the main engine collision obstacles, etc.	应严格遵守操作规程。The operation procedure should be strictly observed.

科恩卓对以下几项不予以负责:



- 未能将手册准确传递给设备安装方。
- 未能按照服务手册要求进行安装和维护。
- 手册中未提及的其它事项或条款。
- 发生故障时, 请退回厂家拆解分析。非厂家认可状态下拆解分析的结论无效。

Cone drive accepts no liability for:



- Failure to pass the manual to the related third party
- Non-compliance with Installation and Maintenance Instructions
- Any omissions or errors in following the manual
- Please send back to Cone drive for disassembly when the slewing drive breaks down. Without Cone drive's approval, all disassembly analyses and conclusions are ineffective.