

# 回转支承的安装与保养

## Slewing Bearing Installation and Maintenance

### 一、防锈、包装与运输

#### Anti-rust, packing, transportation

#### 1) 防锈和包装

##### Anti-rust & Packing

回转支承内、外表面均涂有防锈润滑两用油，如有特殊要求的按技术协议加注相应油脂，包装采用塑料薄膜、塑料编织带等缠绕包装。有特别要求的，可根据需求个性化包装。

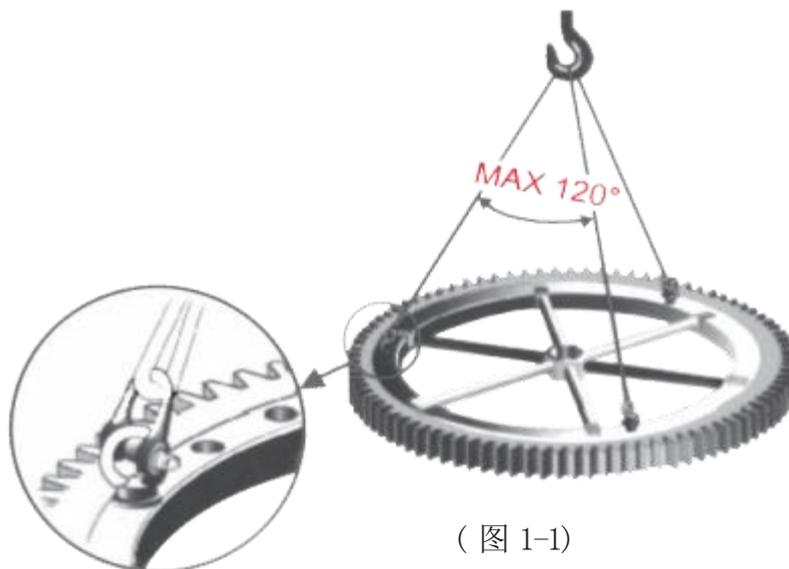
Slewing bearing painted by anti-rust oil and lubrication inside&outside,packed by film,brown paper,plastic knit bag.If have special demand,can personalized packing according to the demand

#### 2) 运输

##### Transportation

在运输期间尽可能使产品水平放置，仅允许产品稍微倾斜、震动，应避免碰撞和雨淋。当不用木箱包装时，要用三块以上的木垫块将产品与汽车底板隔开且放平，以免擦伤回转支承端面。打开包装后，用吊装螺栓拧在内圈或外圈的吊装孔内，水平将轴承搬运到安装位置，两吊索间的夹角不大于 $120^\circ$ ，以免损伤回转支承，确保安全（图 1-1）。

Bearings place while transportation,allow to place bearings a bit inclination avoid hit and rain.If transporting bearings without packing by wooden cases,more than three wooden cushion blocks shall be used to separate the product from the vehicle floor and place it flat.After opening the package,use the transport bolts to screw the hole of inner ring or outer ring,hang up the bearings on level to the mounting place,the angle between the 2 slings is not more than  $120^\circ$ ,so as not to damage the slewing bearing and ensure safety (Picture1-1).



(图 1-1)

## 二、保管

### Storage

1) 防锈期（轴承从出厂后 12 个月）请勿打开包装。超出防锈期后维护和保养应及时，回转支承滚道、外表面、齿面均应进行防锈处理。外表面清洗干净，均匀涂上一层防锈油脂，轴承内腔注入适用油脂（参考第 8 条）。

Anti-rust period(within 12 months after bearing ex-factory),if need maintenance,should have anti-rust treatment to the raceway,surface,gear surface,clear the surface and paint anti-rust grease or industrial Vaseline,fill No.2 pole lithium grease in inner raceway.

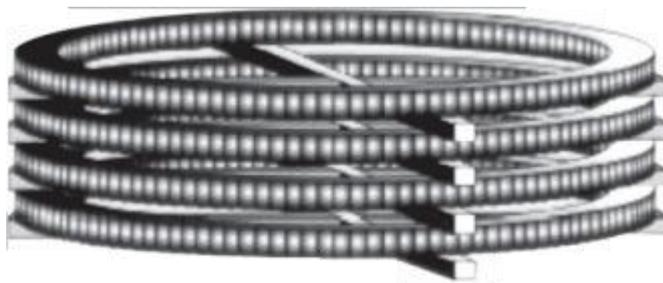
2) 在干燥平坦的场地上水平放置回转支承，禁止回转支承直接接触地面和在阳光下暴晒，注意远离水管、蒸汽管、防止雨淋、以免锈蚀。如果多套回转支承叠放在一起时，每套回转支承之间沿圆周方向至少放置三个均布的木垫块，且上、下层垫块位置应放置一致（图 2-1）。

Place the slewing bearing on level at dry and plain site to prohibit the slewing bearing contact the ground under direct sunlight,keep far away from water pipe,steam pipe to avoid bearings corrosion,if many slewing

bearings pile up together,each slewing bearing place at least 3 equal wooden mats around circle position,the position up and down show be the same(Picture 2-1).

3) 如果回转支承贮藏时间长于 12 个月，应重新防锈。

3) If the slewing bearings storage over 12 months,should anti-rust again.



（图 2-1）

## 三、安装前注意

### Notice before mounting

1) 轴承拆开包装，请注意检查产品合格证，核对产品型号、编号，确认收到的产品与合同订单一致。

Before unpacking the bearing,please check product certificate,product type,serial number,make sure to received the same products with the contract order.

2) 产品型号标牌，位于外圈外径或内圈内径的非齿面上。

Product type label,on the non-gear face outer dia of outer ring or inner dia of inner ring.

3) 轴承滚道表面淬火是不封闭的，淬火连接处是一软带区，在轴承相对应端面上加“S”标识；此区域属于非淬火区。

Quench on surface of bearing raceway are not closed,quench connection is soft zone on bearing side face that marks''S''as non-quench area.

4) 确认收到的产品在运输途中或存放过程中没有受到锈蚀、碰伤和损坏。

Make sure to received products without corrosion,wound,damage.

5) 确认密封圈没有损坏，否则更换密封圈，并检查轴承回转是否灵活。

Make sure that sealing no damage otherwise exchange seals,check bearing rotation agility.

6) 清洗轴承安装表面的防锈油，注意清洗时不要让清洗剂进入轴承滚道中。

Clear the surface grease of mounting bearing,cleanser can not come into bearing raceway while clearing.

7) 严禁私自解体回转支承，移动内部零件。

Forbid to disassemble bearings,move inner parts privately.

齿圈齿表面三个相邻齿如涂有绿色油漆标记，则该处为齿节圆跳动最大点，侧隙调整应在该处调整（图 3-1）。

Gear ring tooth surface has 3 max runout with green mark,drive pinion side backlash must be adjusted.



(图 3-1)

#### 四、安装支架要求

##### Bracket requirements before mounting

1) 回转支承安装基面或安装平台必须清理干净，不允许有小碎杂物、焊渣、局部小凸点及锈蚀现象。

Slewing bearing mounting base level or mount platform must be clean without sundries,broken bits protruding point and corrosion.

2) 安装支架必须有足够的刚性、强度及耐冲击性能，防止回转支承使用时变形，影响其回转精度。

Mounting bracket must be with rigidity,intensity and impact resistance to avoid bearing distortion that influences slewing precision.

3) 采用筒形的焊接支架，为防止支架变形，焊后应进行消除内应力处理，再进行机械加工。对于不易进行机械加工的平面，可以采取垫平法进行安装（图 4-1B）。

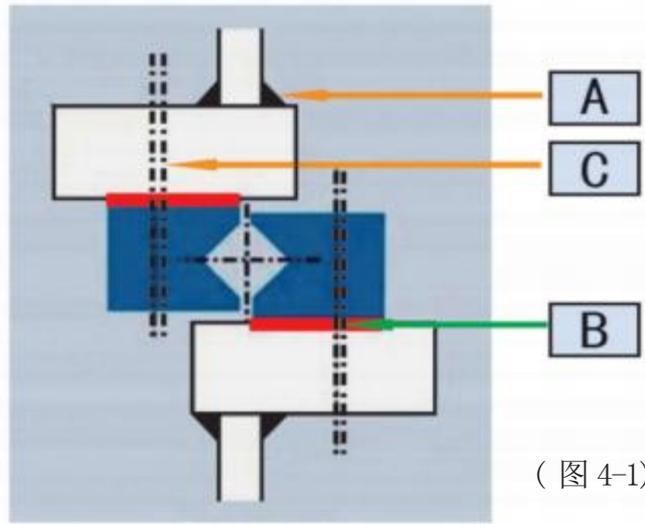
Adopting canister shape welding bracket to avoid bracket distortion,after welding to treat remove inner stress treatment the mechanize,you can see Drawings 5-1 A.For uneasy to mechanize mounting plane,can level up to mount(Picture 4-1B)

4) 支架螺栓孔应与转盘安装孔对应，避免安装干涉引发转盘变形（图 4-1C）。

Bracket bolt hole is the identical with slewing bearing mounting hole to avoid mount distortion(Picture 4-1C).

5) 回转支承连接表面的技术要求（表 4-2），在  $0^{\circ}$  - $90^{\circ}$  - $180^{\circ}$  环形面区域内，只允许有一处波峰达到该值；且其余偏差只允许逐步下降或上升，不许忽降忽升，以避免峰值负荷（图 4-3）。

Slewing bearing connecting surface skills as 5-1 table, in  $0^{\circ}$ - $90^{\circ}$ - $180^{\circ}$  loop area,only allow a wave crest up to the value,other warp allows down or up step by step,not allowed down or up suddenly to avoid peak value load.(Picture 4-3)

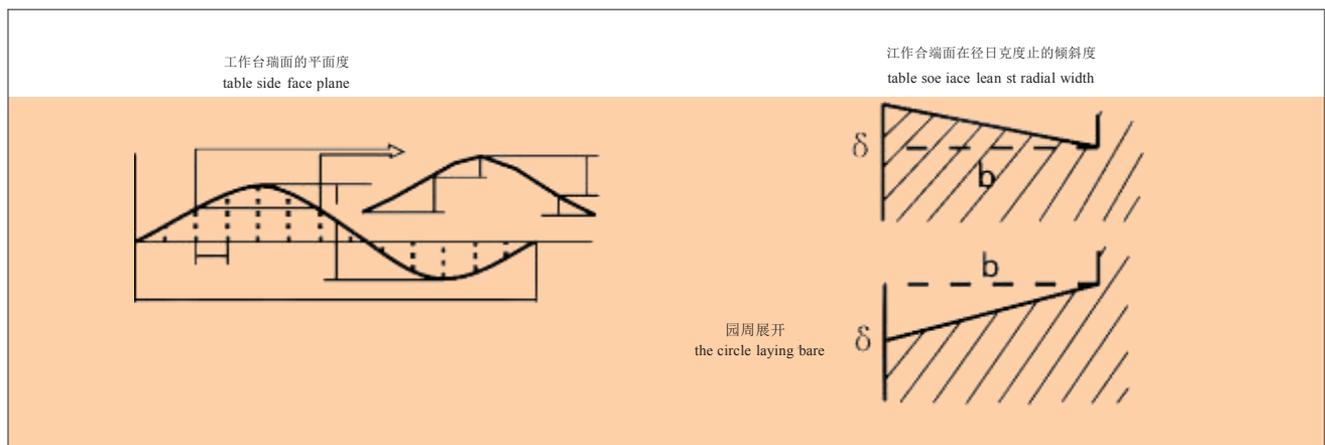


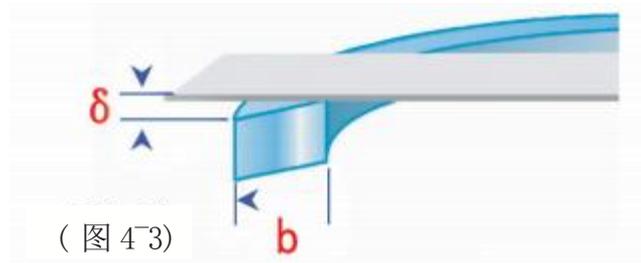
(图 4-1)

表 4-2: P0 级回转支承支承零件链接表面技术

Table4-2:P0 slewing bearing supporting parts connectiong

滚道直径 ( mm ) Raceway dia(mm )	平面度 Plane degree	圆周两相邻单位长度 ( L = 1 个孔距 ) 上相同方向倾斜度 ( s-t )mm Circle border upon unit (L=1 bore distance ) same direction lean (s-t) mm	圆周两相邻单位长度 ( L = 1 个孔距 ) 上相同方向倾斜度 量变化 ( s+t )mm Circle border upon unit (L=1 bore distance ) same direction lean ( s-t ) mm	径向宽度 b 的倾斜度 $\delta$ radial width b lean $\delta$ ( mm )	端面粗糙度 Ra side-face roughness Ra ( mm )
630~1000	0.2	0.0002L	0.0002L	0.10	2.5
1000~1600	0.25	0.0002L	0.0002L	0.12	3.2
1600~2500	0.3	0.0002L	0.0002L	0.15	3.2
2500~4000	0.4	0.0002L	0.0002L	0.20	3.2
4000~6300	0.5	0.0002L	0.0002L	0.25	3.2





(图 4-3)

## 五、安装要求

### Mounting requirements

1) 检查与轴承配合的相关零件的尺寸及加工精度。产品零部件（包括外购、外协件）应具有检验合格证方能进行装配。

Check relative parts sizes and process precision, Product parts (including outsourcing, cooperation part) must have inspection certificate before assembly.

2) 用修配法装配的零件，修整后的主要配合尺寸必须符合设计要求或工艺规定。

Parts assembled by the repair method, main size must fit for design requirements or technical regulations.

3) 装配环境必须清洁，与轴承相关的零件在装配前应清理和清洗干净，不得有毛刺、飞边、氧化皮、锈蚀、切屑、砂粒、灰尘和油污等，并应符合相应清洁度要求。

Assembling environments must be clean, relative parts with bearings must clean up, without burr, oxidation skin, corrosion bits, grains, dust, oil dirt etc before assembly, should comply with clean requirements.

4) 装配过程中轴承及零件应防止磕碰、划伤和锈蚀。

4) bearing and parts can not be knocked, scratch and corrosion during assembly.

5) 不允许用锤直接敲击回转支承，不允许通过滚动体传递安装冲击力，应使用合理专用工具、吊具安装轴承。

Not allow hammer to hit slewing bearings, not allow to transfer mounting wallop through rolling elements, mounting bearings by proper tools, hanges.

6) 将回转支承水平吊放在支承座上以后，用塞尺检测轴承平面与支承座平面的接触情况，如有间隙可以采用机械加工修平或用局部垫平法消除间隙，以防止螺栓拧紧后轴承变形，影响回转支承正常旋转。

(图 5-1)

After the slewing bearing is hoisted on the mounting base horizontally, insert ruler to check bearing plane with supporting housing connection, in case gap to mechanize to repair or level up to avoid bolts screw down to distortion that influence slewing bearing rotation regularly (Picture 5-1).

7) 安装时淬火软带“S”处应置于非负荷区或非经常负荷区，（装填塞滚动体塞子部位总是位于套圈的软带处）。（图 5-2）

Quenching “S” soft zone locating non-load or seldom load area while mounting quenching soft zone, (plug is around soft one on ring). (Picture 5-2).

8) 齿侧隙的检查，为了确保齿轮啮合精度，在组装过程中应保证适当的齿侧隙。在工作过程中，确保大齿圈齿节圆跳动的最高点（三个涂有绿色标记齿）处的啮合侧隙符合设计精度的要求。（图 5-3）

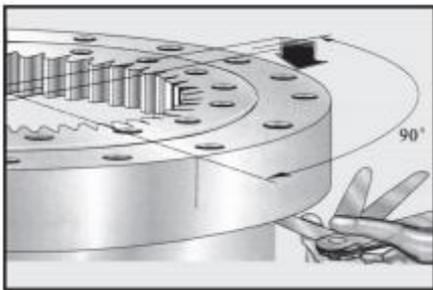
Checking backlash to insure gear meshing accuracy and keep proper backlash while mounting. During operation, ensure that the meshing backlash at the highest point of the pitch circle runout of the large gear ring (3 painting green marks teeth) meets the requirements of design accuracy. (Picture 5-3).

9) 安装时回转支承应采用高强度螺栓连接，并根据回转支承受力情况，选择合适的强度等级，螺栓的规格和强度等级按 GB5782、GB5783 和 GB3098.1 标准选取，螺母的强度等级按 GB3098.2 标准选取。

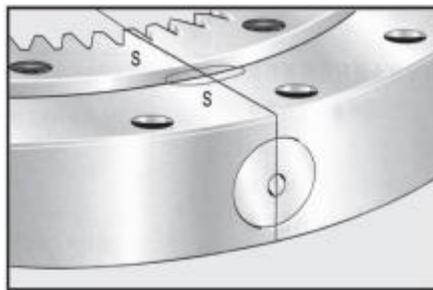
Adopt high strength bolts while mounting, according slewing bearing press condition to select intension class, bolts sizes and strength class standard GB5782, GB5783&GB3098.1, nut strength class are selected to standard GB3098.2.

10) 安装螺栓垫片应采用调质平垫片，严禁使用弹簧垫圈。

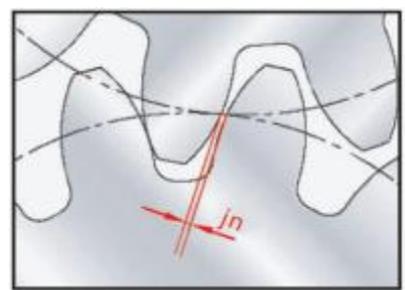
Bolts washer to be used quenching & tempering washer, spring washer are strictly prohibited.



(图 5-1)



(图 5-2)



(图 5-3)

11) 当径向负荷超过轴向负荷的 10% 时，回转支承应有径向定位，回转支承径向定位后，应用力矩扳手分低、中、高三次预紧，并按交叉 180° 方向对称拧紧顺序有步骤进行（图 5-5），确保最后一遍螺栓有相同的预紧力，同时检查轴承的回转是否灵活（图 5-4）。

When radial load > 10% axial load, slewing bearing need radial orientation, after radial orientation, moment wrench has the same pre-press by low, mid, high pre-pressing, and cross 180° direction symmetry screw down (Picture 5-5) to insure the last bolts with the same pre-pressing, meantime check slewing bearing free rotation status (Picture 5-4).

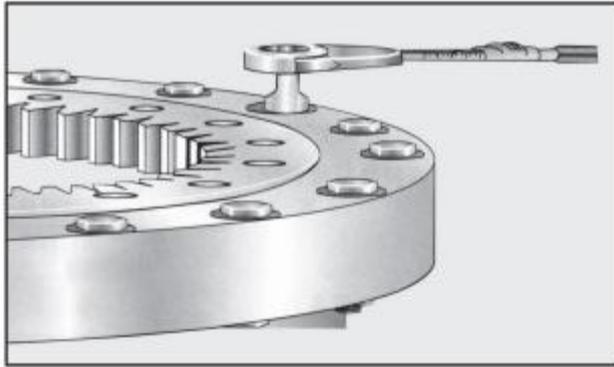
12) 安装螺栓应有足够的预紧力，其预紧力为螺栓材料屈服极限的 0.7 倍，螺栓的屈服极限参照表 5-1；各种不同直径螺栓的预紧负荷参照表 5-2：

Mount bolts with enough pre-pressing, pre-press is 0.7 times of bolts materials yield limits, bolts yield limits as table 5-1; different dia bolts pre-load see table 5-2:

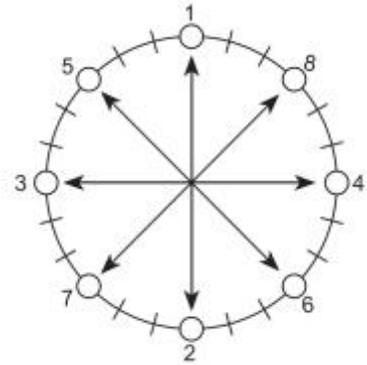
表 5-1：螺栓的屈服极限

Table 5-1: bolts yield limits

螺栓强度等级 Bolts strength class	8.8	10.9	12.9
屈服极限 Yield limits MPa	M ≤ 16 640 M ≥ 16 660	940	1100



(图 5-4)



(图 5-5)

表 5-2: 不同直径螺栓的预紧负荷

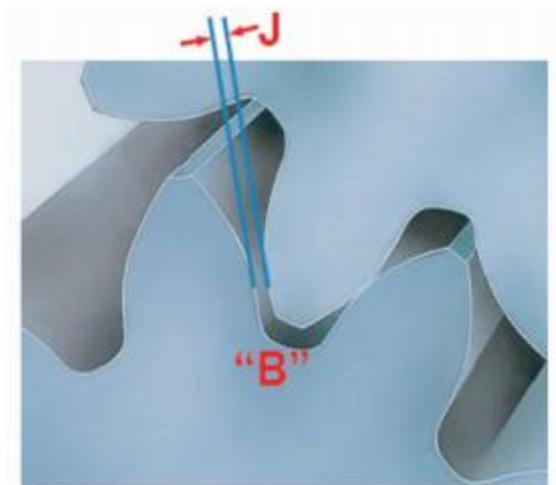
Table6- 2:Different dia bolts pre-load

螺栓规格 Bolts specifications GB5782-86 GB5783-86	安装孔直径 ( mm ) Mount hole dia ( mm )	螺栓强度等级 Bolts strength class( GB3098.1-82 )		
		8. 8	10. 9	12. 9
		螺栓材料的强度极限 $\sigma_{smin}$ ( N/mm <sup>2</sup> ) Bolts materials strength limits $\sigma_{smin}$ (N/mm <sup>2</sup> )		
		640	900	1080
预紧扭矩 MA( Nm )Pre-tighten torque MA ( Nm )				
M12	13. 5	77. 5	110	130
M14	15. 5	120	170	210
M16	18	190	265	320
M18	20	260	365	435
M20	22	370	520	620
M22	24	500	700	840
M24	26	640	900	1080
M27	30	950	1350	1620
M30	33	1300	1800	2160
预紧力 FA ( 10 <sup>3</sup> N )Pre-tightening force FA( 10 <sup>3</sup> N )				
M33	36	293	412	495
M36	39	344	484	581
M39	42	414	581	698
M42	45	473	665	798
M45	48	553	777	932
M48	52	623	876	1050
M52	56	749	1054	1265
M56	62	863	1214	1457
M60	66	1008	1418	1621

## 六、安装后检验

### Inspection after mounting

- 1) 回转支承调试前，应加注合适的润滑脂，边加注边缓慢运转，使润滑脂均布。  
1) Before debugging slewing bearings, should fill in proper grease, move slowly while filling to make grease equally spaced.
- 2) 确认安装没有对回转支承产生变形影响，禁止在回转支承附近搭接地线，焊接回转支承和其它部件。  
2) Make sure not effect bearing distortion while mounting, not allowed grounding line to weld slewing bearings and parts.
- 3) 所有螺栓拧紧后旋转轴承 5 周以上，检查回转支承旋转是否灵活，是否与其它零部件有干涉现象，密封圈是否完好，是否有异常响声。旋转后，重新检测齿侧间隙值，请将这些数值记录下来。(图 6-1)  
3) After all bolts are tightened, rotate the bearing more than 5 circles, and check whether the slewing bearing rotates flexibly and interferes with other parts, whether sealing good, whether have abnormal ringing. After rotation, anew to check backlash data and take a note. (Picture 6-1).



(图 6-1)

## 七、使用保养

### Application and Maintenance

#### 1) 安装螺栓和异常现象的检查

轴承在运转约 100 小时后，检查内、外圈安装螺栓的预紧力距是否满足规定值，以后，每运转 500 小时检查一次。

#### 1) Inspection of mounting bolts an abnormal appearance

After bearing rotation 100 hours, check pre-tighten torque of inner ring and out ring, then once 500 hours inspection.

#### 2) 使用时若出现噪音、冲击、电流突然增大等异常现象，应停机检查，排除故障，必要时应拆检。

2) If coming noise, impact, electric current increasing suddenly in application, stop machine to disport and get rid of trouble, if necessary, inspect by removing.

- 3) 轴承在安装以后,应填充专用润滑脂,如需要可以向制造厂询问,在填充润滑脂时,应边填充边转动轴承,使润滑脂均匀分布直到新的油脂开始挤出密封唇为止。以后间隔 100 小时充填一次,在较高环境温度和灰尘多的情况下加油周期应缩短一些。机器长期停止运转的前后也必须加足新的润滑脂。
- 3) After mounting bearings,fill in dedicating grease as user's requirements.if necessary to ask the maker,filling grease while rotation,grease equally spaced until grease spills over sealing lips.Once 100 hours filling later,filling grease period should be short at high temperature and dusty condition.
- 4) 齿面应每 10 天清除杂物一次,并涂以润滑脂。对于轴承的齿面润滑,因综合工作因素较多,用户可根据具体要求自行选择最佳润滑脂,推荐的润滑脂见表(7-1)。
- 4) Gear surface should clear sundries every 10 days and bearing gear lubrication,User can personally select the finest grease due to combined working elements.Recommendatory grease as table 7-1.
- 5) 使用中防止回转支承受阳光直接暴晒雨淋,禁止用水直接冲刷轴承,以防水进入滚道,严防较硬异物接近或进入齿啮合区。
- 5) Avoid direct sunlight on slewing bearings while usage,can not directly wash bearing with water to avoid water into raceway,avoid hard forcibly eye-winker access or ingress tooth meshing area.
- 6) 定期查看密封的完好情况,如果发现密封圈老化、破损应及时更换,如发现脱落应及时复位。
- 6) Often check sealing,in case seals aging,damaged,change seals timely,In case fall off,reposition timely.

表 7-1:

Table7-1:

环境条件 Circumstance condition	润滑部位 Lubrication position	润滑脂 Lubrication	
		牌号 Trademark	标准号 Standard
低温 -20℃ ~60℃ Low temperature -20° °C ~60℃ 潮湿 wet	滚道 Raceway	1# 或 2# 极压锂基脂 1#or2#pole lithium grease	GB7323-1994
	齿轮 Gear	ZG-S 石墨基润滑 Graphite base grease	SH/T0369-1992
高温 40℃ ~120℃ High temperature 40° °C ~120℃ 潮湿 wet	滚道 Raceway	1# 或 2# 极压锂基脂 1#or2#pole lithium grease 3#MoS2 复合钙基脂 3#MoS2Composed Ca base grease	GB7323-1994
	齿轮 Gear	4# 高温润滑脂 4#High temperature lubrication	SH/T0376-1992
常温 ~50℃、耐海水腐蚀	滚道 Raceway	2# 铝基脂 2#Al base grease	SH/T0378-1992
	齿轮 Gear	2# 铝基脂 2#Al base grease	SH/T0378-1992

## 应用领域 Application field



盾构机  
Shield machine



钢包回转台  
Ladle turret



斗轮堆取料机  
Bucket wheel stacker reclaimer



卸船机  
Ship unloader



克令吊  
Deck crane



定日跟踪系统  
Solar energy



港口起重机  
Port crane



挖掘机  
Excavator



摩天轮  
Ferris wheel



风力发电  
Wind power generation



工业CT机  
Industrial CT machine



海洋平台起重机  
Offshore platform

选型信息表  
Model Selection Information Table

选型信息表 Model Selection Information Table						
主机名称 Main machine					主机型号 Machine model	
工况 Working condition		轴向载荷 (KN) Axial load	径向载荷 (KN) Radial load	倾覆力矩 (KN.m) Overturning moment	转速 (rpm) Speed	工作时间 (%) Working time
载荷 Load	静态 Static 最大: Max					
	试验: Test:					
	... ..					
	动态 Dynamic 最大: Max:					
	试验: Test					
	超载: Overload					
	... ..					
	振动, 冲击程度 Vibration impact	轻度 Light		中度 Medium	重度 Heavy	
使用 Use	使用寿命 (h) Service life					
	安装方式 Installation method	水平: 座式, 挂式 Horizontal: seat type . hang type		垂直: Vertical	其它: Other	
	使用方式 Usage mode	连续: Continuous	间歇: Intermittence	摆动: Swing	其它: Other	
	旋转零件 Rotating parts	外圈: Outer ring		内圈: Inner ring		
	润滑方式 Lubrication method	脂: Grease	油: Oil	其它: Other		
	密封 Seal	主机设置: Main machine setting			轴承设置: Bearing setting	
	轴承驱动圆周力 Bearing driving circumferential force	N				
	环境条件 Environment condition	湿度 (%): Humidity		温度 (°C): Temperature	污染: Pollution	
	轴承工作温度 Bearing operating temperature	°C				