Slewing Bearing Installation and Maintenance Manual

Yantai Haoyang Machinery Co., Ltd.
Table of contents

1 Erection support Design ........................................................................................................... 2
2 Transport, Storage, Unpacking ................................................................................................. 4
3 Installation .................................................................................................................................. 5
4 Post-installation Commissioning and Detection ................................................................ ...... 8
5 Labeling and Signage ................................................................................................................ 9
6 Operation & Maintenance ......................................................................................................... 10
7 Removal of Common Faults ..................................................................................................... 13
8 Quantity Warranty Commitment _ After-sale Service .............................................................. 19

Yantai Haoyang Machinery Co., Ltd.

Address: No.445-1 Jincheng Road,
Zhaoyuan, Yantai, Shandong
Business tel.: +86-535-8248058 E-mail:sales@ythyjx.com
Business tax: +86-535-8248058
Technical support: +86-18853539658 E-mail:tech@ythyjx.com
After-sale service: +86-18865642818 E-mail:service@ythyjx.com
Company website: Http://www.ythyjx.com
1 Erection support Design

Support thickness and structure reinforcement

The slewing bearing has suitable axial rigidity: As its diameter is much larger than its sectional dimension, it must be installed onto a machined bearing support, so that there will be sufficient rigidity for the load transmitted. In this way, it will be sure that the stress will be distributed uniformly, avoiding distortion generated in operation unfavorable to work of slewing bearing.

Therefore, the pedestal thickness should be no less than the minimum value listed in the following table, and the width of support surface should be no less than the corresponding width of the slewing bearing.

<table>
<thead>
<tr>
<th>Raceway center dia. (mm)</th>
<th>500</th>
<th>750</th>
<th>1000</th>
<th>1250</th>
<th>1500</th>
<th>2000</th>
<th>2500</th>
<th>3000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum thickness (mm)</td>
<td>25</td>
<td>30</td>
<td>35</td>
<td>40</td>
<td>50</td>
<td>60</td>
<td>70</td>
<td>80</td>
</tr>
</tbody>
</table>

Cylindrical structure is usually adopted for installation of bearing support. The cylinder wall is aligned to the center of raceway. To make load uniform, thick round base is better than thin base with reinforce, as shown in the following figure:

Slewing Bearing Installation Diagram
1 Erection support Design

Support flatness

To prevent slewing bearing from partial overload and ensure that it will operate flexibly, the installation rack should, after all welding sequences, be treated with internal stress removal, and installation surface machining. The flatness (including angular deviation of plane) should be controlled within a certain range.

Uneven support will lead to raceway deformation, which lead to accidental shutdown or lockout, shortening service life of slewing bearing. The support flatness (including angular deviation of plane) should be controlled within the range as shown in the following table:

<table>
<thead>
<tr>
<th>Raceway center circle diameter (DL mm)</th>
<th>Erection support planar deviation P (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Single-row four-point contact ball bearing</td>
</tr>
<tr>
<td>~500</td>
<td>0.1</td>
</tr>
<tr>
<td>&gt;500 ~ 750</td>
<td>0.12</td>
</tr>
<tr>
<td>&gt;750 ~ 1000</td>
<td>0.15</td>
</tr>
<tr>
<td>&gt;1000 ~ 1500</td>
<td>0.19</td>
</tr>
<tr>
<td>&gt;1500 ~ 2000</td>
<td>0.22</td>
</tr>
<tr>
<td>&gt;2000 ~ 2500</td>
<td>0.25</td>
</tr>
<tr>
<td>&gt;2500 ~ 3000</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Allowable flatness including angular deviation of plane

Support rigidity

The erection support should also have good rigidity. Under maximum allowable load, deflection deformation should be controlled within the range as shown in the following table:

<table>
<thead>
<tr>
<th>Average track diameter (mm)</th>
<th>500</th>
<th>750</th>
<th>1000</th>
<th>1250</th>
<th>1500</th>
<th>2000</th>
<th>2500</th>
<th>3000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum flexural deformation (mm)</td>
<td>0.25</td>
<td>0.3</td>
<td>0.35</td>
<td>0.45</td>
<td>0.55</td>
<td>0.65</td>
<td>0.8</td>
<td>1</td>
</tr>
</tbody>
</table>

Deflection deformation under maximum allowable load

Plastic binder

If the above-mentioned tolerance can’t be met, epoxy resin may be used to replace surface finishing. According to dimensions and unevenness to be compensated for installation purpose, there are many kinds of plastic binders for option.
2 Transport, Storage, Unpacking

Transport
All of our slewing bearings are packed well to avoid damage during transport. The product should be kept in horizontal position during transport and storage. If the slewing bearing is not kept in horizontal position during transport, special measures should be taken.

Like any other precise mechanical device, the slewing bearing should be handled with care. Hoisting of the slewing bearing should be done horizontally with listing bolts. During the process of hoisting, collision, radial collision in particular, must be avoided. Relevant device which can bear weight of the slewing bearing should be used to carry the slewing bearing. Weight of the slewing bearing is indicated in the label.

Storage
A packed slewing bearing has been finished with anti-rust and oil seal surface treatment. Under normal storage condition, the slewing bearing will not rust within 12 months after delivery from plant. For users, if a slewing bearing in stock is still within the above-mentioned period, the slewing bearing can be stored for long time, as long as the original packing is intact. Any slewing bearing which is outside its rust-proof life should be cleaned and oil-sealed again and need replaced packing, if it is still kept in storage.

Any slewing bearing should be filled with oil once every 18 months of storage. (Refer to section 3.6 “Operation & Maintenance”)

Unpacking
When unpacking the slewing bearing before installation, the following precautions should be taken:

- When removing the packing material, be careful to avoid cutting into the real ring.
- When cutting the packing material, it’s better to cut on the external diameter instead of the two ends.

When removing the rust-proof oil at the surface:

- Standard industrial solvent should be used and chlorinated solvent is absolutely prohibited
- Be careful to prevent solvent from flowing into seal ring or raceway
- Before installing the oil cup or connecting the oil tube, the plastic plug or screw plug should be taken off from the oil cup hole.
3 Installation

Erection support confirmation

- Be sure that the erection support structure accords with the technical requirements (refer to “3.1 Erection support Design”)
- Check whether there is any metal chip, weld grain, rust stain, paint or other impurities, which all should be removed.

Centering

When the load is mainly radial, and in particular, when the bearing is installed vertically, forced centering is necessary. Using structural bonding type LOCTITE 586 is the effective way to limit relative displacement between the slewing bearing and its support.

Positioning

The quenching soft belt mark (external mark “S” or at stopped hole) must be set at a non-loaded zone or a non-frequently-loaded zone, i.e. a location which forms a 90-degree angle with the main loaded axle or the loaded arm.

Fit check

After the slewing bearing is hoisted into place, the flatness of the bonded plane is checked with a filler gauge. If there is any gap, machining should be done again, or the gap should be filled plastic or partial gasket, in order to prevent the bearing from distorting after the bolt is tightened. Distortion will affect the performance and service life of the slewing bearing.

Gear backlash check

Before the mounting bolt is tightened, gear backlash should be adjusted according to the highest point of gear pitch circle radial run-out (three teeth marked with green paint), and after the bolt is tightened, gear backlash check should be done all over the gear ring.

When a pinion is installed:

- Make the drive gear adjusted to the maximum eccentric point of gear ring and mark it with a blue line.
- At this moment, backlash must be limited within the calculated value or 0.05xleast value of modulus.
- When several pinions are used, each of them should be adjusted to the same condition.
- In testing, be sure the pinion is well aligned to the gear ring, so that the gear engagement is well contacted.
- Before startup, gear ring and teeth of pinion should be lubricated. (refer to section 3.6 “Operation & Maintenance”)

Check gear backlash
3 Installation

Check fasteners

- Whether up to the recommended grade, e.g. marked with 10.9 at the top
- Whether screw thread is lubricated.
- Bolt’s clamping length \( L_k \geq 5d \) (d-bolt diameter)
- Tempered flat gasket should meet the following requirements:
  - Yield strength must be equal to or greater than 600Mpa
  - Diameter \( DR = 2xd \)
  - Thickness \( h \geq 0.3xd \)

Any spring washer or any other type of washer is absolutely prohibited. Otherwise, warranty will be cancelled.

Tightening mode

Install fasteners and tighten them gently. Then further tighten each fastener to the set value. Suitable fixed value torque wrench or hydraulic tool may be used for this purpose.

Tightening in the “star”-chart style can acquire uniform tightening effect all over the periphery. A bolt should be tightened in 180° directions symmetrically. After the final attempt, be sure the bolt on the periphery has the same pre-tightening force.

Star-chart method
3 Installation

Pre-tightening torque and pre-tightening force

As regards the way of bolt tightening, according to main machine design provisions, certain pre-tightening force should be ensured. Unless otherwise provided, pre-tightening force should generally be 0.7 times of bolt’s yield limit. See the following table for pre-tightening torque or pre-tightening force.

<table>
<thead>
<tr>
<th>Bolt specification (GB/T5782 GB/T5783)</th>
<th>Mounting hole dia. (mm)</th>
<th>Bolt strength grade (GB/T3098.1)</th>
<th>Bolt material yield strength limit σsmin(N/mm²)</th>
<th>Pre-tightening torsion MA(Nm)</th>
<th>Pre-tightening force FA(10³N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M10</td>
<td>11</td>
<td>8.8</td>
<td>640</td>
<td>44</td>
<td>62</td>
</tr>
<tr>
<td>M12</td>
<td>13.5</td>
<td>8.8</td>
<td>900</td>
<td>77.5</td>
<td>110</td>
</tr>
<tr>
<td>M14</td>
<td>15.5</td>
<td>10.9</td>
<td>640</td>
<td>120</td>
<td>170</td>
</tr>
<tr>
<td>M16</td>
<td>18</td>
<td>10.9</td>
<td>640</td>
<td>190</td>
<td>265</td>
</tr>
<tr>
<td>M18</td>
<td>20</td>
<td>10.9</td>
<td>640</td>
<td>260</td>
<td>365</td>
</tr>
<tr>
<td>M20</td>
<td>22</td>
<td>10.9</td>
<td>640</td>
<td>370</td>
<td>520</td>
</tr>
<tr>
<td>M22</td>
<td>24</td>
<td>10.9</td>
<td>640</td>
<td>500</td>
<td>700</td>
</tr>
<tr>
<td>M24</td>
<td>26</td>
<td>10.9</td>
<td>640</td>
<td>640</td>
<td>900</td>
</tr>
<tr>
<td>M27</td>
<td>30</td>
<td>10.9</td>
<td>640</td>
<td>950</td>
<td>1350</td>
</tr>
<tr>
<td>M30</td>
<td>33</td>
<td>10.9</td>
<td>640</td>
<td>1300</td>
<td>1800</td>
</tr>
<tr>
<td>M33</td>
<td>36</td>
<td>10.9</td>
<td>640</td>
<td>293</td>
<td>412</td>
</tr>
<tr>
<td>M36</td>
<td>39</td>
<td>10.9</td>
<td>640</td>
<td>344</td>
<td>484</td>
</tr>
<tr>
<td>M39</td>
<td>42</td>
<td>10.9</td>
<td>640</td>
<td>414</td>
<td>581</td>
</tr>
<tr>
<td>M42</td>
<td>45</td>
<td>10.9</td>
<td>640</td>
<td>473</td>
<td>665</td>
</tr>
<tr>
<td>M45</td>
<td>48</td>
<td>10.9</td>
<td>640</td>
<td>553</td>
<td>777</td>
</tr>
<tr>
<td>M48</td>
<td>52</td>
<td>10.9</td>
<td>640</td>
<td>623</td>
<td>876</td>
</tr>
<tr>
<td>M52</td>
<td>56</td>
<td>10.9</td>
<td>640</td>
<td>749</td>
<td>1054</td>
</tr>
<tr>
<td>M56</td>
<td>62</td>
<td>10.9</td>
<td>640</td>
<td>863</td>
<td>1214</td>
</tr>
<tr>
<td>M60</td>
<td>66</td>
<td>10.9</td>
<td>640</td>
<td>1008</td>
<td>1418</td>
</tr>
</tbody>
</table>

Note: (1) When bolt dimensions are not in conformity with GB/T5782 or GB/T5783, the values in the table should be calculated separately.

(2) Total friction factor between bolt head and clamped surface μ=0.14, with screw thread slightly coated with light oil.
4 Post-installation Commissioning and Detection

After all fasteners are tightened:
- Turn the ring for at least three rounds
- Check the gear engagement backlash value on the whole periphery.
- Measure the total axial clearance under standard load mark the check point.
- All these data are recorded in the equipment maintenance manual. See “Section 5.1 Acceptance Documents” for detail.

Axial clearance detection procedure
- Put the dial gage in between the two rings, near the raceway of main loaded axle as most as possible
- Calibrate it to zero under known load
- Apply measured load
- Read out the oscillating quantity value at the point
- Conduct measurement again at each marked point
- Consider distortion of bearing base and stretch of fastener relative to instrument location.
5 Labeling and Signage

Labeling
Every slewing bearing has its own metal nameplate, which is riveted to the area near clogging of the toothless ring.

Description on nameplate:
- Slewing bearing model
- Finished product number
- Weight (kg)

Installation signage
For the purpose of installing the bearing correctly, the Company attaches the following signs to the slewing bearing:

✧ **Quenching soft belt sign**
- Clogging of toothless ring (ball charge opening)
- A red circle drawn on toothed ring and marked with “Steel S”

The soft belt should be set at non-loaded zone or non-frequently-loaded zone, if possible.

✧ **Gear run-out**
Maximum run-out point of gear is also marked: three green lines drawn on corresponding tooth root

Backlash of driving gear at that area should be adjusted.
6 Operation & Maintenance

Suitable lubrication is necessary for durability of raceway and gear. Lubricating grease improves capability and service life of slewing bearing, while working condition, e.g. load, temperature, speed, and vibration, determines lubricant selection.

**Characteristics of recommended lubricant for slewing bearing:**
- Lithium base grease
- Minimum viscosity of base oil: 150 mm2/S
- NLGI consistency grade: 2
- Anti-friction and extreme pressure additive
- Working temperature: -300 Ca+1200 C
- Four-ball test: Clinkering load STMD 2596 (NT24)>300
- Maximum NDM value (revolving speed x raceway center diameter)
  - For ball slewing bearing=60000
  - For pin roller slewing bearing=30000

**Lubricating grease compatibility table**

According to our experience, the lubricating greases listed in the following table are compatible with each other and with all parts of slewing bearing. Any other grease which is deemed compatible with any of the lubricating greases recommended by the Company is usable. However, molybdenum-containing disulphide MoS2 is strictly prohibited.

<table>
<thead>
<tr>
<th>Grease for raceway of slewing bearing</th>
<th>Lubricating grease designation</th>
<th>Grease for gear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aralub HLP2</td>
<td>ARAL</td>
<td>Aralub LFZ1</td>
</tr>
<tr>
<td>Rhus L 474/2</td>
<td>MOTUL/bECHEM</td>
<td>Berulit GA 400</td>
</tr>
<tr>
<td>Energrease LS-EP2</td>
<td>BP</td>
<td>EnergolwRL/GR 154 GS</td>
</tr>
<tr>
<td>Grease LMX</td>
<td>CASTROL</td>
<td></td>
</tr>
<tr>
<td>Epexa2/Epexelf2</td>
<td>ELF</td>
<td>Cardrex DC1</td>
</tr>
<tr>
<td>Beacon EP2</td>
<td>ESSO</td>
<td>Surret Fluid NX</td>
</tr>
<tr>
<td>Mobilux EP2</td>
<td>MOBIL</td>
<td>Mobilgear OGL 007</td>
</tr>
<tr>
<td>Retina EP2-Alvania EPLF2</td>
<td>SHELL</td>
<td>Malleus GL 205</td>
</tr>
<tr>
<td>Multis EP2-Lical EP2</td>
<td>TOTAL FINA ELF</td>
<td>Ceran AD</td>
</tr>
</tbody>
</table>

This table is subject to update by manufacturer.
6 Operation & Maintenance

Slewing bearing upon delivery from plant:
- When the slewing bearing is delivered from plant, a small amount of No.2 extreme pressure lithium base grease (GB7324). When the slewing bearing is started, the user should refill new lubricating grease according to its working condition.
- The surface of gear and bearing is coated with rust-proof oil for anti-oxidation protection.

Slewing bearing in use:
- Raceway of the slewing bearing should be lubricated periodically. The lubrication cycle depends on the operation condition and environment. We recommend:
  - Lubrication should be conducted once every 150 hours generally
  - Lubrication should be conducted once every 50 hours, if the operation requirements are strict, and the operation environment is humid with much dust.
  - Sufficient grease should be refilled before and after long-term disuse.
  - Lubrication should be conducted once every 6 months during long-term disuse.
- Because there are many comprehensive job factors, users can choose their best grease at will according to specific needs. For example, Mobilux EP 2 and Shell Alvania EP(LF) 2 lubricating grease can be adopted for raceway.
- When filling lubricating grease, turn the slewing bearing slowly to make the grease filled uniformly. In every time of lubrication, the slewing bearing should be turned slowly for at least two rounds until the grease is oozed out of the seal. Every lubricating hole should be lubricated with grease.
- Quantity of lubricating grease may be calculated specifically by our technical department. The practical formula for determining the necessary minimum "Q" (cm$^3$) is shown as follows:

\[
Q = \frac{0.005}{3} x D x H
\]

D = Slewing bearing’s raceway center diameter mm
H = Slewing bearing’s total height mm

In summary, trace of small amount of oozed new grease should be seen at the lip of the seal ring.
- The gear face should be cleaned frequently to remove all impurities and lubricated with relevant grease. Whether by spraying or by brushing, the lubricating grease should completely cover pinion and gear face with gear ring.
- In use, it’s prohibited to flush the slewing bearing directly with water, which may lead to entry of water into raceway. Hard impurities are strictly prevented from approaching or entering gear engagement area.
- In use, attention should be paid to operation of the slewing bearing. If noise, impact or power increases suddenly, the machine should be stopped immediately for checkup and troubleshooting. Overhauling should be done, if necessary.

Special application:
Our design and development department can provide lubricating methods for special working conditions in respect of temperature and speed according to user’s requirements.
6 Operation & Maintenance

Preventive maintenance

- Leak tightness check
  Judge whether the seal ring is intact by visual inspection:
  a) No excessive stretch or damage
  b) Positioned correctly
  c) Rub the wear beside the lip

Please replace the sealing element, if necessary. After re-lubricating, wipe out the old grease and check whether there is any pollutant such as sand, coal dust or metal particle.

- Fastener check
  It is very important that as the fastener of a slewing bearing will necessarily be trouble with work fatigue, the bolts should be checked to see whether they still maintain the required pre-tightening force.

  It is our recommendation that after two to four months of use (100 working hours), every bolt should be re-tightened and should be checked at least once every year (500 working hours) thereafter. If any bolt is found loose, further check must be done and then necessary preventive measure must be taken. Some regulations require that a fastener must be replaced once every seven years or 14,000 working hours.

- Gear check
  When conducting cleanup before re-lubricating the gear:
  a) Check the tooth root, ring and pinion carefully for any impurity
  b) Check the load exerted by pinion on full tooth width of gear to see whether it is uniformly distributed, and rectify the skewed axle, if necessary
  c) Check gear backlash

Limit of serviceability

All slewing bearings provided by the Company have pre-tightening force to ensure normal work and safety in use. When the slewing bearing is in use, due to decrease of pre-tightening force, the axial clearance of the slewing bearing under load would increase significantly. When the clearance increases to the extent that the machine can’t work normally and the material used can’t meet the safety conditions, the slewing bearing should be replaced.

To quantify the coefficient of wear, it’s necessary to know the change in axial clearance of the slewing bearing under load.

- Being brand new: J0
- Being checked: J1

These data are got through measurement under conditions which are same as the initial conditions after checking the condition of fasteners (see “3.4 Post-Installation Commissioning & Detection of Slewing Bearing). The measured data should be included in the corresponding machine maintenance manual.

Abrasion loss: \( u = J1 - J0 \).
- When \( u >= J0 \), bearing should be checked more frequently
- When \( u >= 1.5 \ J0 \), bearing replacement should be considered
- When \( u >= 2J0 \), bearing replacement must be done.
7 Removal of Common Faults

Difficult turning of slewing bearing

Every slewing bearing goes through strict inspection and test run before being released from plant, so all of them are acceptable products. As the slewing bearing has pre-tightening force on its sealing face and frictional force of the sealing face should be overcome for turning, it’s normal that certain starting moment is needed when it is turned.

In case of clamping stagnation in turning, the following method should be taken to remove the trouble:

<table>
<thead>
<tr>
<th>Case</th>
<th>Cause analysis</th>
<th>Troubleshooting methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflexible idling of new product</td>
<td>The slewing bearing has been stored for long time (e.g. over a half year) or the ambient temperature is low, which results in less liquidity of the grease inside, leading to inflexible operation. This case is prominent in cold regions and in winter.</td>
<td>After force is exerted, if it works well without any abnormal sound, it can serve for normal serve, but new grease should be filled until it is oozed from the seal. If operation is accompanied with any abnormal sound, check whether there is any damage caused during transport or storage and feedback the information to our after-sale service department for a solution.</td>
</tr>
<tr>
<td>Inflexible operation after installation</td>
<td>The mounting surface of the main machine does not match well with that of the slewing bearing, resulting in that after installation, axial clearance of the slewing bearing can’t compensate for deformation of the slewing bearing, raceway of the slewing bearing is distorted, and the roller moves with difficulty in raceway (sometimes with abnormal sound).</td>
<td>Rework mounting surface of the main machine to make it in compliance with the requirements; or treat the surface by filling in plastic or partial washer. If flatness is still unacceptable after completion of surface treatment, try to exchange for a slewing bearing with larger clearance.</td>
</tr>
<tr>
<td></td>
<td>Bad gear engagement is caused by failure to adjust gear backlash according to radial top point of gear pitch circle (three teeth marked with green paint). Deformation is caused by compressing the slewing bearing at the top point, resulting in difficult turning or abnormal sound.</td>
<td>Adjust gear and pinion engagement and gear backlash again as required.</td>
</tr>
<tr>
<td></td>
<td>Impurities are jammed in the gear and pinion.</td>
<td>Check and be sure that gear and pinion engagement is free of impurities.</td>
</tr>
</tbody>
</table>
## 7 Removal of Common Faults

**Difficult turning of slewing bearing**

<table>
<thead>
<tr>
<th>Case</th>
<th>Cause analysis</th>
<th>Troubleshooting methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflexible operation in use</td>
<td>The sealing strip is broken, resulting in entry of impurities into raceway.</td>
<td>Replace sealing strip or take effective sealing protection measures, e.g. installing guard plates.</td>
</tr>
<tr>
<td></td>
<td>Failure to lubricate it with sufficient grease periodically according to the maintenance requirement, resulting in abnormal wear and tear of raceway.</td>
<td>Lubricate it with sufficient grease until grease is oozed out from the sealing strip. It’s noted that every oil cup should be oiled, and operation should be kept in oiling, if possible. If wear and tear is serious, the slewing bearing should be replaced. If you continue using it in short time, lubricate it with more amount of grease until grease overflows, so that the scrap iron is discharged as most as possible.</td>
</tr>
<tr>
<td></td>
<td>Abnormal engagement between gear and pinion, with impurities or broken teeth</td>
<td>Remove impurities (if any); replace the slewing bearing, if there is any broken tooth.</td>
</tr>
</tbody>
</table>
# 7 Removal of Common Faults

## Abnormal sound

A slewing bearing just released from plant would make uniform sounds of a rolling steel ball when idling, which is normal. It is not normal if the uniform normal sounds are accompanied with abnormal and loud sounds. Abnormal sounds in use are generally extended phenomena of difficult turning—abnormal sound would be generated if a slewing bearing which rotates with difficulty are turned by force. There are similarities between the causes for the two.

<table>
<thead>
<tr>
<th>Case</th>
<th>Cause analysis</th>
<th>Troubleshooting methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abnormal sound of new product</td>
<td>Slight abnormal sound of new product when being idle. Such abnormal sound would disappear naturally after the product rotates for dozens of rounds. If it does not disappear, it’s possible that the slewing bearing is a little deformed during transport or storage. However, if it operates flexibly, just install it and put it into normal use at ease, and the abnormal sound will disappear naturally after the run-in period.</td>
<td>If the abnormal sounds are loud or still remain after a certain period (3 months), please contact with our after-sale service department.</td>
</tr>
<tr>
<td>Abnormal sound after installation</td>
<td>The mounting surface of the main machine does not match well with that of the slewing bearing, resulting in that after installation, axial clearance of the slewing bearing can’t compensate for deformation of the slewing bearing, raceway of the slewing bearing is distorted, and the roller moves with difficulty in raceway, even produces abnormal sound, when it is serious.</td>
<td>Rework mounting surface of the main machine to make it in compliance with the requirements; or treat the surface by filling in plastic or partial washer. If flatness is still unacceptable after completion of surface treatment, try to exchange for a slewing bearing with larger clearance.</td>
</tr>
<tr>
<td></td>
<td>Bad gear engagement is caused by failure to adjust gear backlash according to radial top point of gear pitch circle (three teeth marked with green paint). Deformation is caused by compressing the slewing bearing at the top point, resulting in difficult turning or abnormal sound.</td>
<td>Adjust gear and pinion engagement and gear backlash again as required.</td>
</tr>
<tr>
<td></td>
<td>Impurities are jammed in gear and pinion.</td>
<td>Check and be sure that gear and pinion engagement is free of impurities.</td>
</tr>
</tbody>
</table>
## 7 Removal of Common Faults

### Abnormal sound_2

<table>
<thead>
<tr>
<th>Case</th>
<th>Cause analysis</th>
<th>Troubleshooting methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abnormal sound in use</td>
<td>If any abnormal sound is produced during use, the first to do is to determine whether it is produced by the slewing bearing. Some sound generated by steel structure or other structural element is often mistaken for sound produced by slewing bearing.</td>
<td>Judge the source of sound by stopping rotation of the slewing bearing (e.g. make the reducer come away) and making other parts run.</td>
</tr>
<tr>
<td></td>
<td>Failure to lubricate it with sufficient grease periodically, resulting in abnormal wear and tear of raceway.</td>
<td>Lubricate it with sufficient grease until grease is oozed out from the sealing strip. It’s noted that every oil cup should be oiled, and operation should be kept in oiling, if possible. If wear and tear is serious, the slewing bearing should be replaced. If you continue using it in short time, lubricate it with more amount of grease until grease overflows, so that the scrap iron is discharged as most as possible.</td>
</tr>
<tr>
<td></td>
<td>Damage of sealing, leading to entry of impurities such as sand or scrap iron into raceway</td>
<td>Replace sealing strip or take effective sealing protection measures, e.g. installing guard plates.</td>
</tr>
<tr>
<td></td>
<td>Failure to check bolt’s pre-tightening force periodically according to the maintenance requirements. The mounting bolt is loose, resulting in deformation of the slewing bearing, which leads to distortion of raceway. The roller moves with difficulty in raceway and produces abnormal sounds, if it is serious.</td>
<td>Tighten bolts again and check pre-tightening force strictly as scheduled.</td>
</tr>
</tbody>
</table>
7 Removal of Common Faults

**Too much rocking (clearance)**

After a new slewing bearing is installed, the axial clearance (rocking quantity) after installation should be measured. Clearance after loading is about 3-5 times that when being idle upon delivery from plant. Any value within this range is normal. If the value is outside this range, the following approach should be taken to get rid of the trouble:

<table>
<thead>
<tr>
<th>Case</th>
<th>Cause analysis</th>
<th>Troubleshooting methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Too much rocking after installation</td>
<td>Insufficient pre-tightening force of mounting bolt</td>
<td>Make the bolt tightened in place with the required value of bolt’s pre-tightening force</td>
</tr>
<tr>
<td></td>
<td>Insufficient structural rigidity of erection support, resulting in overall rocking.</td>
<td>Make the support structure more flexible according to design requirement of the erection support</td>
</tr>
<tr>
<td>Too much rocking in use</td>
<td>Increase of clearance under load within serviceability limits is normal wear.</td>
<td>When clearance increases to 3 times of initial clearance under load, i.e. 9-15 times of idle clearance when delivered from plant, the slewing bearing should be replaced.</td>
</tr>
<tr>
<td></td>
<td>Overloaded operation which leads to crushing of raceway, which is accompanied by large amount of scrap iron contained in grease oozed out as a result of over-oiling.</td>
<td>The slewing bearing should be replaced. If it is still in service for short time, large amount of grease should be filled until it is oozed out, so that the worn scrap iron can be discharged as much as possible.</td>
</tr>
</tbody>
</table>
7 Removal of Common Faults

Broken tooth

If the slewing bearing is troubled with broken tooth or breakage, please preserve the scene and immediately contact with our after-sale service department for analysis and treatment of the case.

<table>
<thead>
<tr>
<th>Case</th>
<th>Cause analysis</th>
<th>Preventive methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broken tooth</td>
<td>In installation, axis of gear is not parallel to that of pinion, resulting in uneven stress on engagement of gear and pinion, so broken tooth is caused if the case is serious</td>
<td>Put soft material (e.g. fuse wire) on the gear engagement area to check evenness of upper and lower part of the engagement. If there is significant difference between upper and lower deformation of the soft material, it means the installation axes are not parallel to each other, and readjustment is needed.</td>
</tr>
<tr>
<td></td>
<td>Bad gear engagement is caused by failure to adjust gear backlash according to radial top point of gear pitch circle (three teeth marked with green paint). The slewing bearing is compressed at the top point, resulting in broken teeth, if the case is serious.</td>
<td>Rotate for one round, then observe and detect gear backlash with a feeler gauge. If compression appears, gear backlash should be readjusted as if the compression point is the top point.</td>
</tr>
<tr>
<td></td>
<td>Mounting bolt for slewing bearing is not tightened enough. Abnormal engagement between gear and pinion is caused by rocking and deformation of bearing. Broken teeth or breakage of slewing bearing is caused, if the case is serious.</td>
<td>Check bolt’s pre-tightening force strictly as scheduled.</td>
</tr>
<tr>
<td></td>
<td>Operation against rules: Overload and high-speed revolution; main machine collides with (sweeps) an obstacle, etc.</td>
<td>Strictly observe the main machine operation rules.</td>
</tr>
<tr>
<td></td>
<td>Accidental impact collision (e.g. being impacted by collapsing objects lifted during hoisting) occurs, resulting in broken teeth or even breakage of slewing bearing, if the case is serious.</td>
<td>Sufficient observation and preparation should be made before operation to prevent accidental events from happening.</td>
</tr>
<tr>
<td></td>
<td>Impurities are jammed in the area of engagement between slewing bearing and pinion.</td>
<td>Check it constantly and be sure gear and pinion engagement free of any impurity.</td>
</tr>
</tbody>
</table>
8 Quantity Warranty Commitment — After-sale Service

Warranties
The slewing bearing produced by the Company provides warranty over normal operation within normal use range compliant with the following provisions:

- Use condition of a standard product shall accord with the application conditions and with the technical specifications in this sample and the installation & operation instructions.
- Use condition of all products shall accord with the conditions set out by the customer in the completed Slewing Bearing Type Selection Technical Parameter Table.

Warranty period
- Warranty for this product shall be effective for one year after installation or for a maximum of 18 months after delivery. This warranty period shall only be limited to the estimated service life of the product, as relevant calculation or the service life set out in other documents of the Company.

Exceptions to warranty
Warranty for any slewing bearing product shall become invalid under any of the following circumstances:

① Failure to fill out, reply and send back the Slewing Bearing Type Selection Technical Parameter Table of the Company

The slewing bearing is a high-tech product that can meet special requirements. Provision of a suitable product fully depends on the Company’s accurate understanding of the customer’s working conditions and expected use condition.

The Slewing Bearing Type Selection Technical Parameter Table is a table containing numerous technical data and characteristic requirements. This table should be filled out systematically before ordering by customer.

Provision of a product just as needed by a customer depends on the customer’s accurate and sufficient answer to the Slewing Bearing Type Selection Technical Parameter Table. Therefore, if the customer answers the Slewing Bearing Type Selection Technical Parameter Table incorrectly, the Company may refuse to assume the responsibility of warranty.

② Not following the Company’s recommendations
Handling, use, installation and maintenance are not in compliance with the recommendations set out in the installation & operation manual for the product sold, particularly:

Carriage
- Handling equipment unfit for quality and weight requirements of the product
- Product use not in compliance with the technical specifications and product application conditions

Installation
- Bearing structure size is incorrect. The size is less than the specified minimum requirements and the flatness is too big.
- The location of slewing bearing’s quenching soft belt does not avoid the main load area.

Fastening
- Pre-tightening force of bolts and nuts is not in compliance with our recommendations and requirements
Any slot, fan-shaped, spring or tempered washer of any unknown designation whatever are used

Lubrication
• Lubricating grease model and re-lubrication cycle are not as recommended by us

Storage
• Failure to update external protective material after storage for 6 months
  • Failure to re-lubricate the slewing bearing after storage for 18 months

⑤ Modify, dismantle or repair the product without prior consent of the Company
④ Damage caused by overuse
③ Damage caused by normal wear of material
Increase of clearance under effect of load within limit of serviceability is normal wear
No warranty is provided for quick-wear parts such as seal ring. Strictly speaking, we provide no warranty for dysfunction caused directly or indirectly by customer’s negligence.

Performance of warranty
To obtain warranty for normal operation of the slewing bearing product, you are supposed to complete the following matters:
• The customer shall file the letter of fault declaration before the specified deadline (warranty period).
• The Company’s findings on the fault.
• Review technical specifications of corresponding product, the Company’s recommendations and other conditions for use and warranty.
Don’t return the product without prior consent of the Company.

Warranty
If the declared fault has been investigated and inspected, the Company will:
• Repair the slewing bearing and replace damaged parts as necessary
• Replace the slewing bearing free of charge
• Refund the payment for the purchased slewing bearing

In summary, the Company shall have the right to choose the most suitable solution for any problem found.

The Company has strict restrictions on warranty over repair, replacement or return of product, so it will make no compensation for any consequence related to any fault: shutdown of machine, other material damage, profit loss……
If any fault of the slewing bearing is caused by negligence of the customer, particularly due to non-compliance of the Company’s recommendations, cost and expenses for investigation on the damage parts including all travel expenses for transport and technical service personnel to the site of use.

Attention
All data and materials included in the present sample are already calculated and checked. We assume no responsibility for any error or omission herein and we reserve the right to improve or rectify any of the experiments, formulas and graphs technically without prior notice.
All previous versions shall become invalid as of the date on which this sample is released.