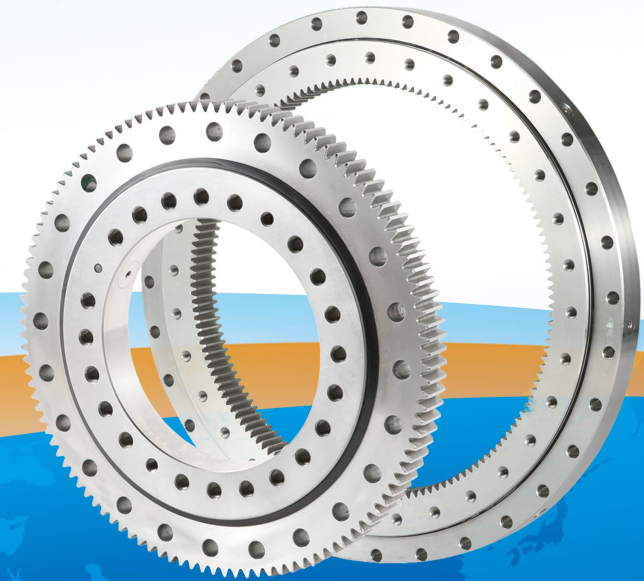




Professional slewing solution provider

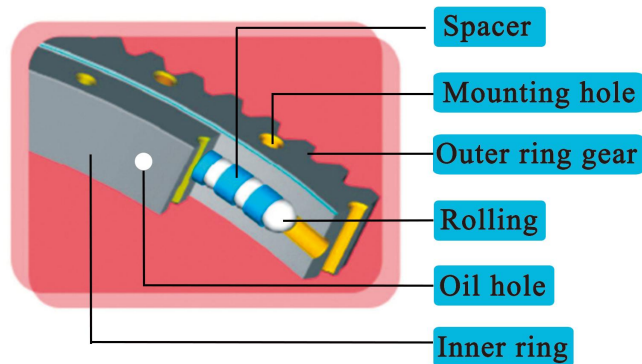
# Installation and Maintenance Manual for Slewing Bearing



Professional ◆ Excellence

## Introduction of Slewing Ring

Standard design slewing rings are suitable for operating temperature ranging from  $-30^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .



### 1. Transport, Handling and Storage

Transport pallets with crane or forklift horizontally and ensure they cannot slip. Never transport slewing rings vertically.

As supplied slewing rings are generally packed for storage in a covered store and for a period not exceeding 6 months. Light surface corrosion can usually be removed from exterior surfaces and it is more important that the raceways are well greased and dust free. In extreme cases after long term storage bearings may need professionally reconditioning before installation.

In addition to the fixing bolts check, raceway wear checking is also carried out in operation (mainly at significant important rotary connections) using the measurement method "tilting clearance". The tilting clearance is the difference of the mutual ring displacement in axial direction measured under load by minimum and maximum tilting moment.

### 4.3 Seals

Seal is usually specific to each manufacturer and the profiles and groove dimensions vary.

Seals must be inspected at least annually and replaced as required. Standard nitrile seals will perish in approximately 5 years. Viton seals (usually reserved for high temperature applications) should last slightly longer.

The installation and maintenance manual provide important instructions and must be precisely followed. More detailed information can be provided upon request.

## 4.2 Preventive maintenance

A visual examination makes it possible to ensure the integrity of the protective seals. After greasing, wipe clean residue of old grease and check for pollutants as sand, coal, metallic particles, etc. It is particularly important to check that the required preload level of the bolts is still maintained as the fasteners of the slewing rings are essentially working in fatigue. We recommend retightening the fasteners after the first two or four months of utilization and then proceeding to a systematic yearly check. If any bolt is found loose, a further in deep examination is essential.

The necessary preservative measures must then be exercised. When inspecting, the following method can be used (approximately valid for crane operation)

| Inspection No. | Number of Operating Hours | Inspection Action                                                                                                                                                                                                                               |
|----------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.             | About 200 hours           | -inspection of all bolts torque<br>-if more than 10% of bolts are loose, another inspection is necessary after about 200 operating hours                                                                                                        |
| 2.             | About 600 hours           | -inspection of all bolts torque                                                                                                                                                                                                                 |
| 3.and further  | About after 2000 hours    | -if one or more bolts are loose to less than 80% of the prescribed torque, these and both adjoining bolts must be replaced by new ones<br>-if 20% of all bolts have less than 80% prescribed torque, and all bolts must be replaced by new ones |
|                | Each 12000 hours          | -replace all bolts by new ones                                                                                                                                                                                                                  |

## 2 Installation Preparation

### 2.1 Unpacking slewing rings

Carefully unpack the slewing ring. Care must be taken not to cut and damage the integral seals.

### 2.2 Slewing ring mounting structure requirement

The supporting surfaces must have a flat machined surface (usually machine roughness 6.3 ) and be rigid enough to eliminate torsional buckling under load that would affect the smooth operation of the slewing ring.

The thickness if the supporting plates should be no less than that indicated below-which is offered as a rough approximation only.

| Raceway Dia(mm)           | 500 | 750 | 1000 | 1250 | 1500 | 2000 | 2500 | 3000 |
|---------------------------|-----|-----|------|------|------|------|------|------|
| Min Support Thickness(mm) | 25  | 30  | 35   | 40   | 50   | 60   | 70   | 80   |

The width of the supporting surface must be at least equal to the width of the ring it supports.

### Permissible flatness deviation and deflections in supporting structure

In order for the bearing to slew smoothly, the mounting structure should be stress - relieved after welding procedure. The maximum permissible out - of - flatness, including slope and axial deflections is detailed in the respective tables. See table 1.

Regarding the slope of the machined surfaces, the figures shown in the table refer to a support width of 100mm. Another important factor is to ensure that the maximum value is reached only once per 180° sector.

As in the case of out-of-flatness, any deflections in the supporting structure must not be allowed to lead to localized buckling which might cause tight spots in the raceways. This could easily lead to over-loads. For this reason, the same conditions as for the out-of flatness will apply.

For the maximum permissible deflections in Table 2, the permissible slope may be twice the value “P” in Table 1 (Reference width 100mm)

The maximum permissible axial deflections ”V” shown in Table 2 apply to all bearings types and are indicated as a function of the track diameter of the bearing.

**Table 1:**

Permissible out-of-flatness including slope “P” of the machined support surface

| Raceway Diameter | Out of flatness including slope per support surface “P” in mm |                                                      |                                 |
|------------------|---------------------------------------------------------------|------------------------------------------------------|---------------------------------|
| DL(mm)           | Single-row ball<br>Four point contact ball bearings           | Double-row ball<br>Eight point contact ball bearings | Roller bearing<br>slewing rings |
| To 1000          | 0.15                                                          | 0.20                                                 | 0.10                            |
| To 1500          | 0.19                                                          | 0.25                                                 | 0.12                            |
| To 2000          | 0.22                                                          | 0.30                                                 | 0.15                            |
| To 2500          | 0.25                                                          | 0.35                                                 | 0.17                            |
| To 4000          | 0.30                                                          | 0.40                                                 | 0.20                            |
| 4000~6000        | 0.40                                                          | 0.50                                                 | 0.30                            |
| >6000~8000       | 0.50                                                          | 0.60                                                 | 0.40                            |

## 4 Greasing and Daily Maintenance

Maintenance involves regular lubrication of raceways and gear together with inspection of the fastening bolts and wear of the bearing.

### 4.1 Greasing and Regreasing

A suitable lubrication is essential for the longevity of the raceways and gears. Please fully grease the raceway with EP2 based grease or equivalent grease before installation. The greasing frequency varies according to utilization and working environment. We would recommend regreasing every 100 hours for ball type slewing ring, every 50 hours for roller type slewing ring. The frequency should be reduced when conditions of application are severe, such as high temperature, high humidity, dust and large temperature difference environment.

Greasing is required before and after a long non-operation period.

Slowly rotate the bearing while greasing the raceway.

During cleaning prior to regreasing the gear, check carefully for any foreign body at the tooth root ring and pinion. Check the even load distribution of the pinion on the entire width of the ring gear and correct alignment of the axes if needed. Check the backlash of the pinion and ring gear.

### 3.3 Pinion installation

The pinion should be located approximately at 90° of the major loading axis. Adjust the driving pinion to maximum eccentric point of the gear ring, usually with green or red paint covering 2 to 3 teeth. The backlash of the slewing ring gear and pinion must be within the limits of the calculated values or minimum at 0.05 x module. When several pinions are used, each one must be adjusted to the same conditions. During test, make sure good alignment of the pinion and of the slewing ring axes permits a satisfactory contact across all gear width. Before running, lubricate the slewing ring gear and pinion gear.

### 3.4 Running test

After final tightening of all fasteners:

Rotate the ring for at least 3 turns. Recheck the backlash value on the gear mesh over one full revolution. Measure the total deflection under a known load. The checked point should be marked. It is advisable to register these values in a maintenance logbook specific to the machine.

Deflection measurement under load mounted slewing ring  
Operating process:

Place a measuring device between the two rings as close as possible to the raceway on the main load axis: precision grade 0.1mm minimum. Calibrate to zero under a known load. Apply a measured load. Read the deflection value at the point considered.

Repeat this measurement in the previously marked points. Take into account the deflection of the support structure and the fasteners elongation corresponding to the instrument position.

Table 2:

Maximum permissible axial deflections for contact surfaces at maximum operating load.

| Raceway Diameter in mm DL      | To 1000 | To 1500 | To 2000 | To 2500 | To 3000 | To 3500 | To 4000 | To 5000 | To 5500 | To 6000 |
|--------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Max. axial deflections in mm V | 0.6     | 0.8     | 1.0     | 1.3     | 1.6     | 2.0     | 2.5     | 3.0     | 3.6     | 4.2     |

Besides, the inner and outer ring of a slewing ring must rest fully on the supporting structure surface.

### 2.3 Mounting elements selection

Choose bolts of recommended grade, quality class 10.9(metric) or SAE Grade 8 bolts. Grade 12.9 bolts are only used in very rare circumstances.

Don' t use a fully threaded bolt.

Only use treated hardened flat washers.

Use of elastic washers is absolutely prohibited. Do not reuse bolts, nuts and washers.

## 3 Installation of Slewing Ring

### 3.1 Hardness gap on slewing rings

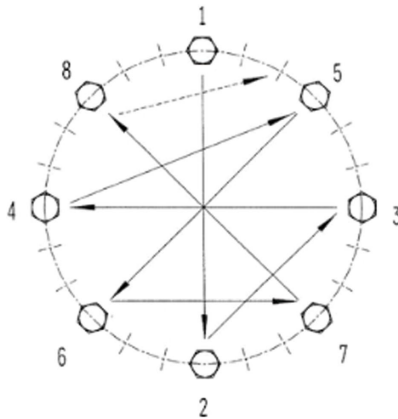
The hardness gap occurs in the process of raceway inductive hardening and is located between the end and the beginning of the hardening. These areas must be placed in the area of least load: ideally at zero load when installing slewing ring.

The position of the hardness gap on each of the slewing ring can be told as follows:

| Slewing ring | Internal geared type | External geared type | Gearless type            |
|--------------|----------------------|----------------------|--------------------------|
| Inner ring   | S marking            | Filler plug          | S marking or filler plug |
| Outer ring   | Filler plug          | S marking            | S marking or filler plug |

### 3.2 Fastening of slewing ring

Before fastening, use a feeler gauge to check whether the surface of the slewing ring is completely supported by the mounting structure. If this is not the case, the support surface of the mounting structure must be reworked. Please follow the sequence pattern below to install bolts:



Tighten all fasteners lightly. And tighten to a specified value using a properly calibrated torque wrench; hydraulic devices are advisable.

When tightening the whole bolt circle, ensure a uniform tightening torque. The recommend bolt tightening torque values are listed in the table below:

| Bolt Thread Size | Bore dia(mm)<br>DIN/ISO 273 | Tightening Torque at $\mu=0.14$ Nm |                 |
|------------------|-----------------------------|------------------------------------|-----------------|
|                  |                             | Bolt Class 8.8                     | Bolt Class 10.9 |
| M12              | 14                          | 79                                 | 117             |
| M14              | 16                          | 126                                | 184             |
| M16              | 17.5                        | 193                                | 279             |
| M18              | 20                          | 270                                | 387             |
| M20              | 22                          | 387                                | 558             |
| M24              | 26                          | 666                                | 954             |
| M27              | 30                          | 990                                | 1395            |
| M30              | 33                          | 1350                               | 1890            |
| UNC              |                             | Grade 5                            | Grade 8         |
| UNC 5/8"-11      | 18                          | 180                                | 260             |
| UNC 3/4"-10      | 21                          | 320                                | 460             |
| UNC 7/8"-9       | 25                          | 520                                | 730             |
| UNC 1"-8         | 27.5                        | 770                                | 1100            |
| UNC 1 1/8"-7     | 32                          | 970                                | 1560            |
| UNC 1 1/4"-7     | 35                          | 1370                               | 2190            |
| UNF              |                             | Grade 5                            | Grade 8         |
| UNF 5/8"-18      | 18                          | 210                                | 290             |
| UNF 3/4"-16      | 21                          | 360                                | 510             |
| UNF 7/8"-14      | 25                          | 580                                | 820             |
| UNF 1"-12        | 27.5                        | 860                                | 1210            |
| UNF 1 1/8"-12    | 32                          | 1100                               | 1760            |
| UNF 1 1/4"-12    | 35                          | 1520                               | 2440            |

The slewing ring should be rotated during tightening process as this will indicate the development of any tight spots, the cause of which must be investigated.

The bolt torque should be checked before machine is finally operated to check for any loss of pre-load due to the structure settling.