

## SLEWING BEARING



## INSTALLATION & MAINTENANCE

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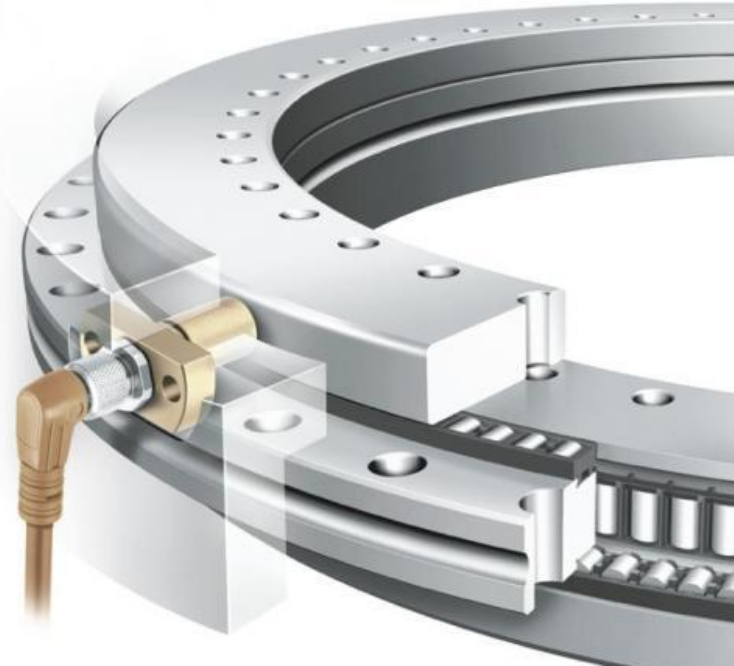
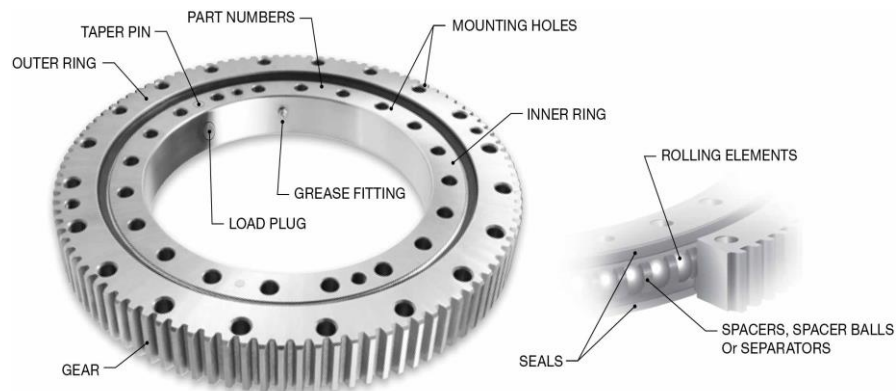
## Introduction

The "**slewing ring**" product is a high technology product selected for precise parameters. It was designed and manufactured to the ISO 9000 standard and supplied based on the information given in drawing or questionnaire.

We suggest you study the conditions in catalogue and our installation & maintenance handbook.

Please also train and check end user has been correctly identified in our questionnaire, the installation requirements and our product suitable environmental conditions, maintenance conditions have to be fully respected.

Please contact us for any detail questions. We are willing to give your service after sales.



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## 1. Transportation & Handling

### 1.1 DELIVERY CONDITIN FROM TENSUN:

#### Raceway system

The slewing bearings are delivered filled with standard greases unless no special lubricant and special grease quantities are required.

#### External surfaces

External surfaces protected with anticorrosive protection .



#### Gearing



The gearing is not greased. Anti-corrosion treatment as for external surfaces.

### 1.2 TRANSPORTATION & HANDLING

Slewing bearings, like any other part of a machine, require careful transportation and handling. Improper handling during transportation would result damage. They should always be transported and stored in horizontal position. For safe handling of bearings which include transport holes, high tensile lifting eye bolts must be used. If they have to be transported vertically, they will require internal cross bracing. The bearing weight must be indicated on the crate or pallet.

Impact loads, particularly in a radial direction, vibration, must be avoided.

	 <b>DANGER</b>
	<p><b>Danger of life by overhead load</b></p> <ul style="list-style-type: none"> <li>•Do NOT step underneath the load</li> <li>•Use suitable slings</li> <li>•Use suitable lifting devices</li> <li>•Suitable transport tap hole are stated in the bearing drawing</li> </ul>

	 <b>CAUTION</b>
	<p><b>Risk of skin irritation caused by preservative</b></p> <ul style="list-style-type: none"> <li>•Safety gloves must be worn for removal</li> <li>•Pay attention to the producer's data</li> </ul>

## 2. Storage

The packed rings have an anticorrosive surface protection allowing a 6-month-storage in a covered and temperate room generally.

A suitable protection must be applied for longer storage.

-Approx. 6 months in roofed storage areas.

-Approx. 12 months in enclosed, temperature-controlled areas (temperature at  $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$ , humidity under 80%).


**Outside storage is not allowed.**

Longer storage periods will necessitate special preservation. After the slewing bearing has been stored for a relatively long time, an increased frictional torque may be observed caused by the suction adhesion of the sealing lip. Careful lifting of the sealing lip with a blunt object around the entire circumference and several clockwise and counterclockwise rotations of the slewing bearing through 360 degrees will reduce the frictional torque to normal.

Slewing bearing should be stacked horizontally. The spacer plate between each ring should be at 100mm distance from the ground so as to avoid the potential for corrosion. The stacking quantity in total should not exceed 5 sets of bearings. There should be a minimum of 3 wooden support blocks at 120 degrees spacing to support the weight of each bearing. Those blocks should be in same position within the same vertical stack height.

In case the bearings are kept in storage over one year, open the package, remove the rust inhibitor then apply new coat.



	CAUTION
	<p><b>Sensitive surface</b></p> <ul style="list-style-type: none"> <li>•Do not open the packing with a sharp blade</li> <li>•Surface may be damaged</li> </ul>

### **3. Operating conditions and special requirements**

#### **3.1 TEMPERATURE**

The normal working temperature of the slewing rings ranges from -20°C up to +70°C. Lower or higher temperatures are possible but require special design provisions by our Engineering Department.

#### **3.2 ENVIRONMENT**

In case when the working environment is particularly aggressive :

- . sea atmosphere,

- . dust or abrasive environment (sand, coal...),

particular protection devices must be incorporated such as : .

- labyrinths, shields, oil-bath.

Preventive maintenance operations will be increased to ensure normal operation.

#### **3.3 SHOCKS, VIBRATIONS**

If the slewing rings are continuously solicited by shocks and/or vibrations, the customer must mention it in the specifications in order to allow us to design the right piece.

#### **3.4 SPEED**

The slewing rings can work whether by oscillating motion or continuous motion. It is necessary to check that the circumferential raceway speed remains within the acceptable limits of respective bearing's capacity.

## 4. Installation Preparation

### 4.1 UNPACKING - PREPARATION

When unwrapping the bearing :

- Take care not to cut the protective seals when removing the packing paper.
- Cut this paper, preferably on the external diameter, and not on the upper or lower faces. When degreasing the bearing :
- Use a standard commercially available solvent.  
Chlorine containing solvents are prohibited.
- Take care not to introduce any solvent under the seals or in the raceways.
- Before fitting the grease nipples or junction pipes, remove the plastic caps or the Hc screws from the greasing holes.

### 4.2 MOUNTING STRUCTURE REQUIREMENT

#### 4.2.1 Mounting structure thickness:

The **slewing ring** has a moderate axial stiffness: the diameter is large compared to the cross section. It must be mounted on a machined supporting base, ensuring sufficient stiffness with regard to the loads to be transmitted. This makes it possible to ensure an even distribution of stresses and to avoid any deformation during operation, which would be harmful to the good working of the **ring**. Therefore, it is necessary to use supporting bases with a minimum thickness not less than the values indicated in the table below. The width of the supporting surface must be at least equal to the width of the ring it supports. Refer **table 4.2.1**.

**Table 4.2.1**

Raceway mean diameter (mm)	500	750	1000	1250	1500	2000	2500	3000
Minimum thickness (mm)	25	30	35	40	50	60	70	80

#### 4.2.2 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 process. The maximum permissible out-of-flatness, including slope and axial deflections is detailed in the respective **table 4.2.2**.

**Table 4.2.2**

Track Diameter	Maximum permitted flatness (mm)		
DL(mm)	Four-point Contact Ball Bearing	Double-row Ball bearings	Roller Bearings
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

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

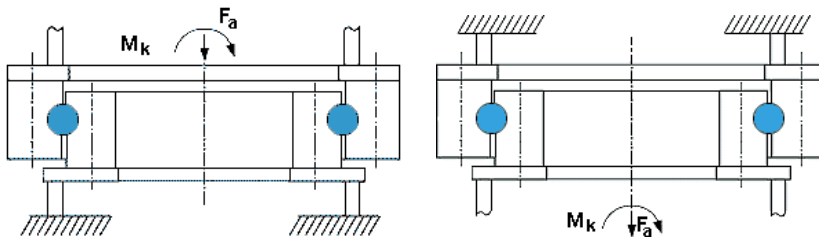
cause tight spots in the raceways. This could easily lead to over-loads. For this reason, the same conditions as for the out-of-flatness will apply. For the maximum permissible deflections in **Table 4.2.3**,

**Table 4.2.3**

Track Diameter in	To 1000	To 1500	To 2000	To 2500	To 3000	To 3500
Max. axial deflections in mm	0.6	0.8	1.0	1.3	1.6	2.0

## 4.3 THE 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.
- Elastic washers are absolutely prohibited.
- Do not reuse bolts, nuts and washers.



The torque is affected by the rolling friction coefficient, the rolling elements, spacers, seals, load distribution and the load.

Some other factors affecting the torque are:

- The out-of-flatness including the slope of the upper and lower

companion structure.

- The grease filling and the type of grease.
- The lubrication of the lip seals and the seal preload.
- The variation in the bearing's clearance resulting from installation.
- The torque calculated is, of course, subject to certain fluctuations, which can be estimated with approx.  $\pm 25\%$ .
- Specially designed bearings with reduced torque can be supplied. Please contact us regarding the applications for such bearings

## 5. Installation

### 5.1 HARDNESS JUNCTION ON SLEWING BEARING

The hardness junction occurs in the process of raceway inductive hardening and is located between the end and the beginning of the hardening marked with "S". These areas must be placed in the area of least load or at zero load when installing slewing ring. (the load plug is always located in this area)

The position of the hardness (soft zone) junction 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

### 5.2 FASTENING

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

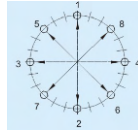


reworked. Please follow the sequence pattern as picture shows to install bolts.

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:

- 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.

Bolt Strength Grade	8.8	10.9	12.9
Yield Limit (N/mm <sup>2</sup> )	640 (M≤16), 660 (M > 16)	940	1100
Bolt Diameter	Preload (kN)		
M10	26	38.5	45
M12	38.5	56	66
M14	53	77	90
M16	72	106	124
M18	91	129	151
M20	117	166	194
M22	146	208	243
M24	168	239	280
M27	221	315	370
M30	270	385	450
M33	335	480	560
M36	395	560	660
M39	475	670	790
M42	542	772	904
M45	635	905	1059
M48	714	1018	1191
M52	857	1211	1429
M56	989	1408	1648
M60	1156	1647	1927

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

- Check for chips, weld seam particles, corrosion signs, etc.
- Check the good mating of the rings on the supports.

## 5.3. 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 the test, make sure the alignment of the pinion and of the slewing rings axes permits a satisfactory contact across all gear width. Before running, lubricate the slewing ring gear and pinion gear.

## 5.4 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 0.1 mm 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.

## 6. Protection Survey

### 6.1. BOLT CHECK

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 bolts loosed is found, a further in deep check must be conducted.

No	Number of Operating Hours	Inspection Action
1 .	About 200 hours	-inspection of all bolts torque -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.	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 -if 20% of all bolts have less than 80% prescribed torque, and all bolts must Be replaced by new ones
	after 12000 hours	Replace all bolts by new one.

### 6.2 SEALS INSPECTION

A visual examination makes it possible to ensure the integrity of the

protective seals:

- Absence of excessive stretch or rips,
- correct positioning,
- wear of the friction lip.

If necessary, replace the seal.

### 6.3 ORIENTATION SURVEY

During cleaning prior to re-greasing of 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 the alignment of the axes if needed.

Check the backlash value.

### 6.4 GEAR INSPECTION

Gear teeth become smoothed and worn in the course of use.

A permissible wear limit depends very much on the application.

Experience indicates that a wear value of up to 0.1 x module per flank is permissible.



**DANGER**

Hazard due to exposed gear

- Keep hands away from moving parts

## 7. Protective Maintenance

Scheduled maintenance is essential so as to ensure that the bearing operates at optimum performance and is able to achieve its calculated life expectancy. Besides the regular protective survey, routine maintenance must be scheduled and conducted.

### 7.1 GREASING AND RE-GREASING

A suitable lubrication is essential for the longevity of the raceways and gears. Please fully grease the raceway based grease or equivalent grease before installation. The greasing frequency varies according to utilization and working environment. General, the lubrication interval we recommended is 150 hours. If under extreme working instruction, we would recommend re-greasing every 60 hours for ball type slewing ring, every 40 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.

The operating conditions such as loads, temperatures, speeds, vibrations, etc... determine the lubrication interval.

- Greasing is required before and after a long non-operation period.
- Slowly rotate the bearing while greasing the raceway.
- During cleaning prior to re-greasing 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.

### 7.2 RACEWAY

Standard grease: **Mobilux EP2** or equivalent

Unless otherwise specified, the **slewing rings** are delivered greased.

### 7.3 GEAR

A protection against oxidation is applied

### 7.4 GREASING HOLES

Radially or facially located, depending on design, these holes are generally tapped M10 x pitch. 1.00 and closed by plastic caps or Hc screws.

Remove these plugs before fitting the slewing ring with grease nipples or linked to a centralized lubrication system.

#### Caution :

The filler plug for the rolling elements has a blind tapped hole which is not a greasing hole.

### 7.5 REGREASING METHODS

Whenever the application allows it, greasing must be carried out during rotation at slow speed, on two revolutions minimum, through all the greasing holes.

## 8. Marking

### 8.1 IDENTIFICATION TAG

Each ring is individually identified by a metallic tag riveted close to the filler plug on the ungeared ring.

This tag states:

- manufacturing date,
- part number of the ring,
- its serial number,
- its weight in kilograms.

### 8.2 INSTALLATION MARKS

In order to permit the correct installation of the bearing, TENSUN slewing rings are marked as follows :

#### Hardening junction (soft zone):

- Located on the filler **plug** for the ungeared ring.
- Marked by a “**S**” on the gear face for the geared ring with production tracking number.

These areas must be placed as close as possible to the neutral axis of the loads, ideally at zero moment axis.

#### Gear run-out:

The maximum point of the gear run-out is marked by:

- **Green line** on the corresponding

The backlash of the driving pinion must be adjusted at this point.

