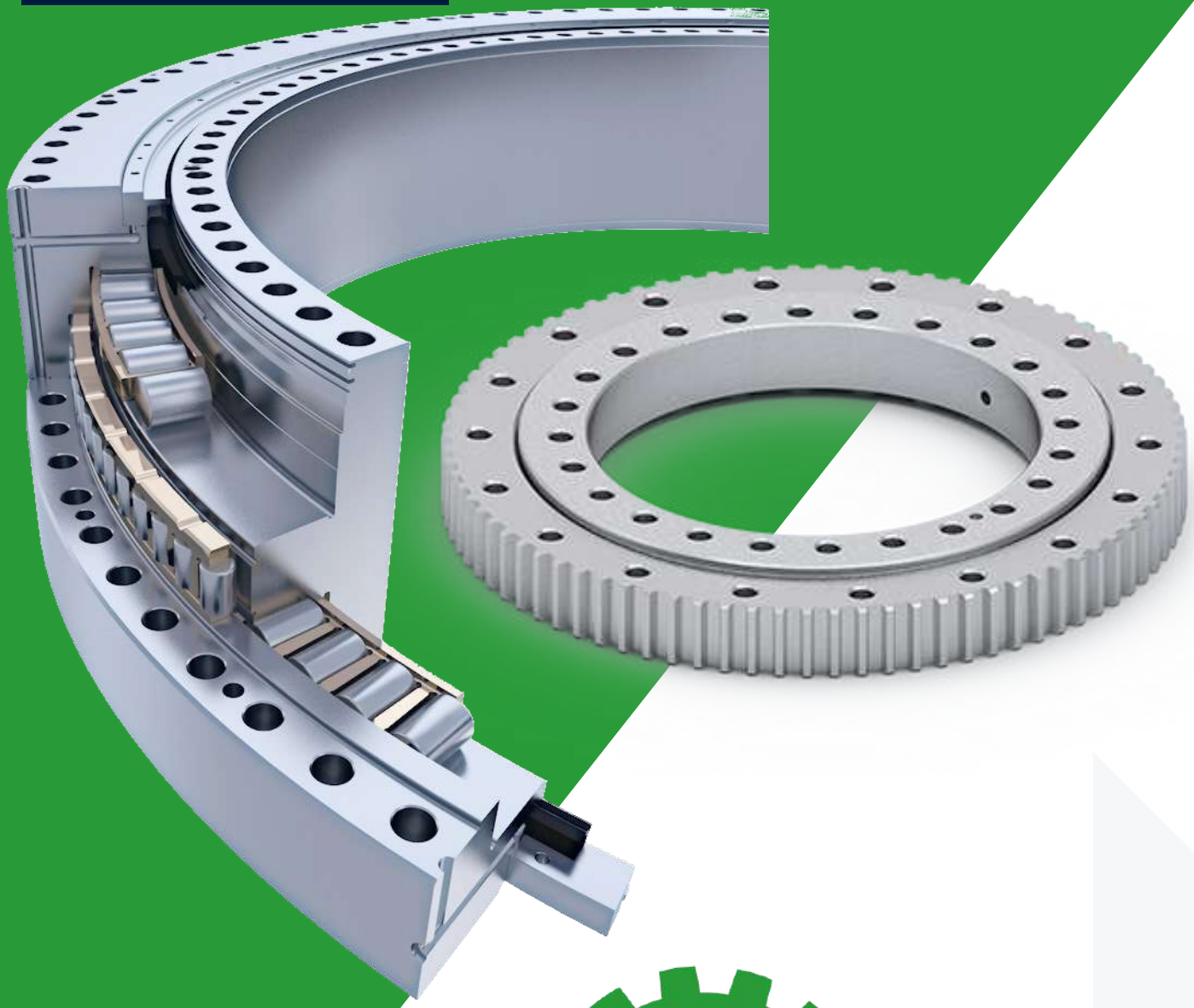
MANUAL



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ASSEMBLY-LUBRICATION MAINTENANCE

TABLE OF CONTENTS	
Transport and Storage and Standard delivery conditions	p. 03
Assembly	pp. 04-08
Lubrication	pp. 09-10
Maintenance	pp. 11-16
Warranty	p. 17

-Transport – Storage - Delivery conditions -

Transport

Our slewing bearings are packed in such a way as to prevent their damage during transport.

Transport and storage shall be carried out only in a horizontal position; however, if the transport position is inclined (not vertical), the slewing bearing shall be stiffened with a cross piece.

As all machine parts, slewing bearings must be handled with caution, avoiding any impact.

Lifting shall be carried out using accessories suitable for the weight of the slewing bearing

Storage

Packed slewing bearings are provided with an anti-corrosion surface treatment that enables their storage for up to 6 months in a closed room, protected form extreme temperatures. For longer storage periods, appropriate protection is required.

Standard delivery conditions

(unless otherwise required)

Outer surfaces
Surfaces treated with protective oil that can be removed with grease cleaners.

Rolling system
Lubricated with protective lubricant before greasing:

Teeth
Not greased, treated like the outer surfaces of the slewing bearing.

-Assembly-

-Unpacking and preliminary operations-

When unpacking the slewing bearing, take care not to cut the protective gaskets when removing the packaging. Cut the packaging preferably on the circumference of the slewing bearing and not on its surface.

Degrease the slewing bearing using a standard thinner; **avoid using thinners that contain chlorinated solvents.**
Make sure that the thinner does not reach between the gaskets or inside the raceway.

-Slewing bearing positioning-

To ensure the correct positioning, smooth operation and durability of the slewing bearing, respect the markings on the Transmec Slewing Bearings

Hardened section start and end joints: S highlighted in RED

The unhardened connection zone between the beginning and the end of the race hardened section is marked by an 'S' punched on the circumference of the slewing bearing outer ring and inner ring; in the case of toothed rings, the area will be marked on the side opposite to the support surface. When assembling the slewing bearing, make sure that the hardened section joints are in the area that is not subject to the maximum loads.

Grease fittings:

All grease fittings must be accessible.
If necessary, provide appropriate grease ducts to ensure lubrication at the intended points.
The use of a centralised lubrication system is always recommended

Teeth eccentricity:

The maximum pitch circumference ovalization point is indicated by three teethed painted in **GREEN.**
When assembling the slewing bearing, make sure that in that area, the clearance between the sides of the wheel teeth and those of the pinion is at least 0.05 mm times the gear module.

Attention

Before assembling the slewing bearing, check the condition and correct positioning of the gasket.

The slewing bearing cannot be fixed by welding; also, no welds can be carried out near the bearing because the heat may cause the material to warp.
Also, avoid using the slewing bearing as a current conductor when welding; the balls, rollers and races may get damaged.

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-Assembly-

-Support surfaces-

A flat surface is the first requirement for proper installation.
The upper and lower support surfaces must be perfectly coplanar and machined by machine tool, so that the slewing bearings do not seize once the fixing bolts are fully tightened.

Also, the support surfaces must be perfectly clean and present no traces of welding slag, burrs due to machining operations, paint stains etc.

Thanks to their specific load carrying capacity, FA.RE.MEC slewing bearings are able to transmit extremely high loads, even if their diameter and thickness are relatively small.
Therefore, the slewing bearings must be installed on a rigid connecting structure, free of bends, and that can prevent, as far as possible, by means of high-strength bolted connections, any deformations caused by the stress of the operating loads.
The stiffness of the structure and its deformation (deflection) under load must be even, without any sudden variations, so that the forces can be properly transmitted to the slewing bearing, without reaching peak values in limited sections.

We recommend reinforcing the connecting structures with vertical ribs placed at the circumference of the race, in such a way as to contain the bending of support surfaces under maximum working load within permissible limits (table 01).

Table 01

Race diameter	Max permissible axial deflection
Up to 1000 mm	0.6 mm
Up to 1500 mm	0.8 mm
Up to 2000 mm	1.0 mm
Up to 2500 mm	1.3 mm
Up to 3000 mm	1.6 mm
Up to 3500 mm	2.0 mm
Up to 4000 mm	2.5 mm

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-Assembly-

-Support surfaces-

The maximum flatness error "P" (mm) of the lower or upper support surface is given by the sum between the circumferential component and the radial component (taper ratio)
It also depends on the design of the slewing bearing and on the average diameter of the race.
This error, overall, should not exceed the limit values indicated in table 02
If these values are exceeded, please contact our technical department.

The taper error of machined support surfaces refers to a conventional ring width of 100 mm. To avoid higher deviations and peak values concentrated in small sections, in a range of 0°, 90°, 180° the error is allowed only if it is characterised by constant incremental or decremental gradients.

Table 02 Maximum flatness error "P", including taper ratio, for machined support surfaces

Race diameter mm	Flatness error "P", including taper ratio (mm) for:		
	Single-row ball slewing bearing	Double-row ball slewing bearing	Cylindrical roller slewing bearing
Up to 500	0.10	0.15	
Up to 1000	0.15	0.20	0.10
Up to 1500	0.20	0.25	0.12
Up to 2000	0.23	0.30	0.15
Up to 2500	0.25	0.35	0.17
Up to 4000	0.30	0.40	0.20

-Bolt tightening-

Before connecting the slewing bearing to the supporting structures, make sure that the fixing bolts meet the desired quality standards (8.8-10.9-12.9).

The bolts must be slightly oiled

It is allowed the use of hardened flat washers, especially for normalised steel bearings; the use of any kind of spring washers is strictly forbidden and renders the warranty null and void.

Place all the bolts on the outer and inner ring and tighten them slightly.

Tighten each ring at a time as shown in figure 1, respecting the torque values indicated below

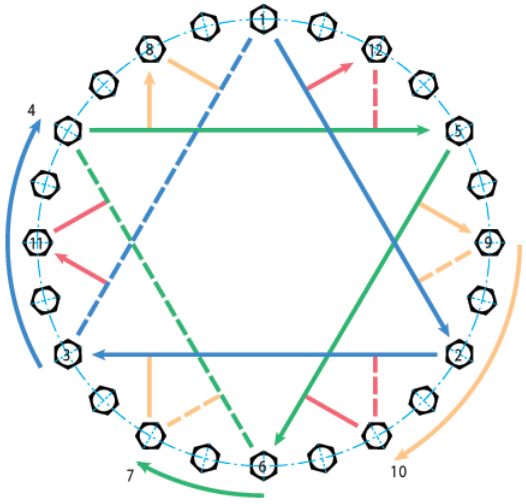

Figure 1

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-Assembly-

-Tightening torques-

Tighten the bolts using torque wrenches or hydraulic systems. See table 03 for the tightening torques for bolts in quality classes 8.8-10.9-12.9

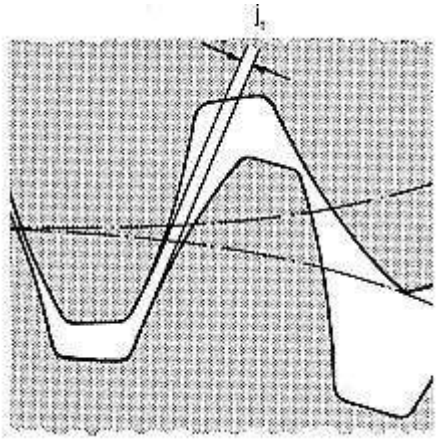
Table 03

Resistance class in accordance with DIN/ISO 898	8.8	10.9	12.9
Metric thread according to ISO DIN 13	Tightening torque * for torque wrench (Nm)	Tightening torque * for torque wrench (Nm)	Tightening torque * for torque wrench (Nm)
M 10	45	67	78
M 12	78	117	135
M 14	126	184	216
M 16	193	279	333
M 18	270	387	459
M 20	387	558	648
M 22	522	747	873
M 24	666	954	1116
M 27	990	1395	1665
M 30	1350	1890	2250

-Installing the pinion -

The slewing bearing-pinion connection shall be made by bringing the three Slewing bearing teeth painted in **GREEN** , which represent the maximum eccentricity value, to match the position of the pinion. Adjust the clearance between the teeth of the slewing bearing and those of the pinion making sure that the following condition is met:

Minimum clearance between teeth Js = 0.05 module



Carry out the same procedure if more than one pinion is used.
During installation, check the vertical alignment between the slewing bearing-pinion teeth. Once the installation is complete, before lubricating the assembly, give it a few turns to make sure that the connection has been done correctly.

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-Lubrication-

- Introduction -

Proper lubrication is essential for extending the life of the races and teeth. The lubricant shall be chosen according to the imposed stress, loads, temperatures, speeds, vibrations, etc.

After assembling the system, GREASE the rolling elements and the teeth.

-Lubricants-

For the first greasing, as well as for all subsequent greasing operations, we recommend using only greases that meet the characteristics indicated in table 04; make sure that the temperature range is correct.

Table 04

Esso	Race	Beacon EP 2	-20°C up to +120°C
	Teeth	Cazar K 2	-25°C up to +65°C
IP	Race	Athesia EP 2	-25°C up to +100°C)
	Teeth	Viscum Fluids	-10°C up to +150°C
Mobil	Race	Mobilux EP 2	-20°C up to +120°C
	Teeth	Mobiltac 81	-30°C up to +120°C
Shell	Race	Shell Alvania EP 2	-25°C up to +130°C
	Teeth	Malleus GL 95	20°C up to +230°C

Lubrication is intended to reduce friction, ensure sealing and protect against corrosion.
Therefore, make sure to grease the bearings properly, until you can see a film of grease over the entire edge of the gaskets.
To facilitate grease distribution, rotate the bearing during greasing.
Any excess grease coming out of the bearing must be properly removed and disposed in accordance with current regulations.

When using automatic lubrication systems (recommended), the manufacturer if the lubricant must confirm its suitability for use. Low temperatures require the use of specific lubricants.

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-Lubrication-

-Lubrication frequency-

Races

To be determined according to the operating conditions. As a rule of thumb, lubrication should be carried out every 100 hours of operation.
More frequent lubrication is recommended in tropical environments, very humid or dusty places, impregnated with impurities and subject to severe temperature changes or if the bearings are used continuously.

Before and after a period of inactivity, lubricate the slewing bearing while rotating it. When cleaning the bearing, make sure that the detergent does not reach into the rolling system and does not damage the gaskets; in any case, check the gaskets every 6 months.

Teeth

We recommend using an automatic lubrication system.
In case of manual lubrication, grease the teeth before using the system.
Then lubricate the system every week; the teeth should be covered in a thin layer of grease at all times.

CAUTION GREASE THE SYSTEM PRIOR TO COMMISSIONING

When using greases other than those indicated in table 04, the customer must request the confirmation from the grease manufacturer that the type of grease used is compatible with and suitable for the materials used by us in making the spacers and gaskets.

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-Maintenance-

- Checking the gaskets -

Visually inspect the gaskets to check their condition. Make sure they show no signs of excessive tension, tears or splits and check their correct positioning and the wear of the free edge.

If necessary, replace the gaskets. After greasing, remove any used grease, check for the absence of pollution by sand, coal, metal parts and analyse the presence of foreign objects.

-Checking the teeth-

When cleaning and greasing the teeth, check for the absence of foreign objects at the base of the slewing bearing and pinion teeth, verify the vertical alignment of the pinion along the entire length of the slewing bearing teeth and if necessary, restore it. Check that the minimum clearance between the sides of the slewing bearing teeth and those of the pinion is that indicated in the “Installing the pinion” section.

-Checking bolt tightness-

To compensate for settling phenomena, check that the fixing bolts are always tightened according to the torque values indicated in the “Assembly bolt tightening” section.
During this operation, make sure to remove the stress imposed by external forces on the bolts.
This check shall be carried out within the first 100 hours of operation and then it is recommended to repeat it approximately every 600 hours or every 3 months of operation.
Decrease the intervals if used under special operating conditions, if the bolts are loose, or if the application is subject to specific control standards.

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-Maintenance-

-Checking the races-

The internal clearances of the slewing bearings supplied by FA.RE.MEC ensure optimal operating conditions.The clearance is determined according to the type and diameter of the races and rolling elements and is outlined briefly below.

Single-row ball bearings	
Race diameter	**Clearance (mm.)**
Up to 800 mm.	0.10 ÷ 0.30
From 800 mm. to 1500 mm.	0.15 ÷ 0.35
Over 1500 mm.	0.20 ÷ 0.50

Double row ball bearings	
Race diameter	**Clearance (mm.)**
Up to 800 mm.	0,05 ÷ 0,20
From 800 mm. to 1500 mm.	0,10 ÷ 0,30
Over 1500 mm.	0,15 ÷ 0,45

Cross roller bearings	
Race diameter	**Clearance (mm.)**
Up to 800 mm.	0,07 ÷ 0,17
From 800 mm. to 1500 mm.	0,10 ÷ 0,25
Over 1500 mm.	0,20 ÷ 0,45

Triple-row roller bearings		
Race diameter	**Radial Clearance (mm)**	**Axial Clearance (mm)**
Up to 1500 mm.	0.10 ÷ 0.25	0.06 ÷ 0.10
From 1500 mm. to 2000 mm.	0.15 ÷ 0.35	0.08 ÷ 0.20
Over 2000 mm.	0.20 ÷ 0.45	0.10 ÷ 0.30

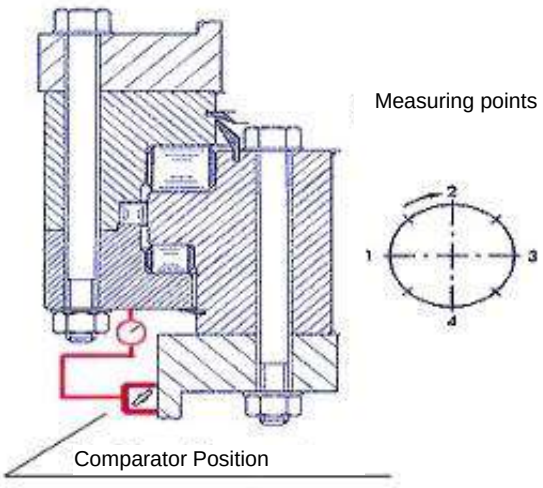
The clearances will increase over the life of the product due to normal wear; therefore, we recommend observing the procedures below.

-Slewing bearing clearance measurement method-

Check the clearance before starting using the slewing bearing (new slewing bearing); this will be the reference value for subsequent checks.
It is important that all subsequent checks be carried out using the same method.

Clearance check - loads outside of the race: The test shall be carried out using an analogue comparator with a tolerance of 0.1 mm while the slewing bearing is at a standstill.
Measure the oscillation between the negative and positive moment condition at 4 equidistant points along the circumference of the slewing bearing.
To reduce the impact of elastic deformation (deflection) of structures, perform the measurements, as far as possible, between the rings of the bearing and, however, as close as possible to the race; the test will be carried out with static loads without impact.

Clearance measurement with loads outside the rolling diameter



Record the oscillation values measured at the 4 points during slewing bearing commissioning on the maintenance sheet under Initial clearance.

Record the oscillation values measured at the 4 points at regular intervals throughout the life of the slewing bearing on the maintenance sheet under Clearance found.

The measurements shall be carried out under the same loading conditions and at the same points used during slewing bearing commissioning

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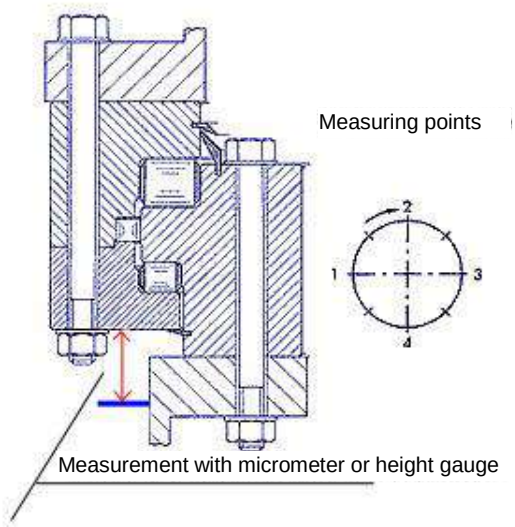
-Maintenance-

Loads inside of the race:

The test shall be carried out using a height micrometer or gauge with a tolerance of 0.1 mm while the slewing bearing is at a standstill.
Measure the distance between the frame and the ring of the slewing bearing connected to the upper frame at 4 equidistant points along the circumference of the slewing bearing.

Measurement with loads inside the race



Record the values measured at the 4 points during slewing bearing commissioning on the maintenance sheet under Initial clearance.

Record the values measured at the 4 points at regular intervals throughout the life of the slewing bearing on the maintenance sheet under Clearance found.

The measurements shall be carried out under the same loading conditions and at the same points used during slewing bearing commissioning

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-Maintenance-

Maximum permissible clearance increase-


Replace the slewing bearing when the difference between the initial clearance value and that currently measured exceeds the maximum values indicated in the tables for your specific slewing bearing type, rolling element size and race diameter. Tables 05-06-07 on the following pages.

Table N° 05 **Single-row ball slewing bearings**

Race diameter up to (mm)	Ball diameter (mm)										
	18	20	22	25	30	35	40	45	50	60	70
600	1.1	1.1	1.1	1.1	1.2						
800	1.1	1.2	1.2	1.2	1.3						
1000		1.4	1.4	1.4	1.5	1.7	1.9	2.1	2.5		
1250			1.5	1.5	1.6	1.7	2.0	2.2	2.6		
1500				1.6	1.7	1.7	2.0	2.3	2.6		2.0
1750					1.7	1.8	2.1	2.3	2.7	2.9	3.0
2000					1.8	1.9	2.2	2.4	2.8	2.9	3.1
2250						2.0	2.3	2.5	2.9	3.0	3.2
2500			.			2.0	2.3	2.6	2.9	3.1	3.2
2750							2.4	2.6	3.0	3.2	3.3
3000			.				2.5	2.7	3.1	3.2	3.4

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-Maintenance-

Maximum permissible clearance increase-


Replace the slewing bearing when the difference between the initial clearance value and that currently measured exceeds the maximum values indicated in the tables for your specific slewing bearing type, rolling element size and race diameter. Tables 05-06-07 on the following pages.

Table N° 06 **Double-row ball slewing bearing**

Race diameter up to (mm)	Ball diameter (mm)										
	18	20	22	25	30	35	40	45	50	60	70
600	1.6	1.6	1.7	1.7	1.8						
800	1.7	1.7	1.8	1.8	1.9						
1000	1.8	1.8	1.9	1.9	2.0	2.5	2.6	2.8			
1250		1.9	2.0	2.0	2.1	2.6	2.8	3.0	3.4	3.6	
1500			2.1	2.1	2.1	2.2	2.7	2.3	2.6		2.0
1750			2.3	2.3	2.4	2.5	2.8	3.1	3.6	3.8	4.0
2000				2.4	2.5	2.6	2.9	3.2	3.7	3.9	4.1
2250					2.6	2.7	3.1	3.3	3.8	4.0	4.2
2500			.			2.8	3.2	3.4	3.9	4.1	4.3
2750						2.9	3.3	3.5	4.0	4.2	4.4
3000			.				3.4	3.6	4.1	4.3	4.5

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Maintenance-

-Maximum permissible clearance increase-


Replace the slewing bearing when the difference between the initial clearance value and that currently measured exceeds the maximum values indicated in the tables for your specific slewing bearing type, rolling element size and race diameter. Tables 05-06-07 on the following pages.

Table N° 07 **Roller slewing bearings**

Race diameter up to (mm)	Roller diameter up to (mm)						
	16	20	25	32	40	50	60
400	0.2	0.22	0.25				
500	0.2	0.22	0.25	0.28			
650	0.26	0.28	0.3	0.33	0.38		
800	0.26	0.28	0.3	0.33	0.38		
1000	0.3	0.32	0.34	0.38	0.43		
1250	0.4	0.42	0.44	0.48	0.53	0.6	
1500	0.50	0.52	0.54	0.58	0.63	0.70	
2000		0.62	0.64	0.68	0.73	0.80	0.90
2500			0.74.	0.78	0.83	0.90	1.00
3000				0.88	0.93	1.00	1.10


The values in the previous tables indicate the maximum slewing bearing wear limit at which the safe operation of the bearing is still ensured

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-Warranty-

-FA.RE.MEC slewing bearing warranty-

Never subject the slewing bearing to loads higher than its carrying capacity, indicated in the technical documentation. Since it is an important part of the machine, the slewing bearing must be handled with care, paying particular attention during all assembly and maintenance phases; for best operating conditions and long life, observe the instructions in this manual. We recommend that maintenance and assembly operations be carried out by specialist staff. The company disclaims all liability for any damage arising out of failure to apply the instructions in this manual, improper or incorrect use of the product or tampering of any kind:

Changes made to the products, including drilling, turning, welding.

Use of spring washers or any other washers that are not flat to fix the bolts

Use of bolts that are not compatible with the bearing fixing holes.

Disassembling the cover and/or the rolling elements

Damage caused by carelessness or accidents.

Materials claimed as defective shall be returned at the customer's expense. If the verification indicates the presence of a manufacturing defect, FA.RE.MEC will repair or replace the product without any compensation for damage or direct or indirect costs of any nature or for any reason.
FA.RE.MEC reserves the right to make changes or updates to its products and to this manual as a result of future technical developments at any time, without prior notice.

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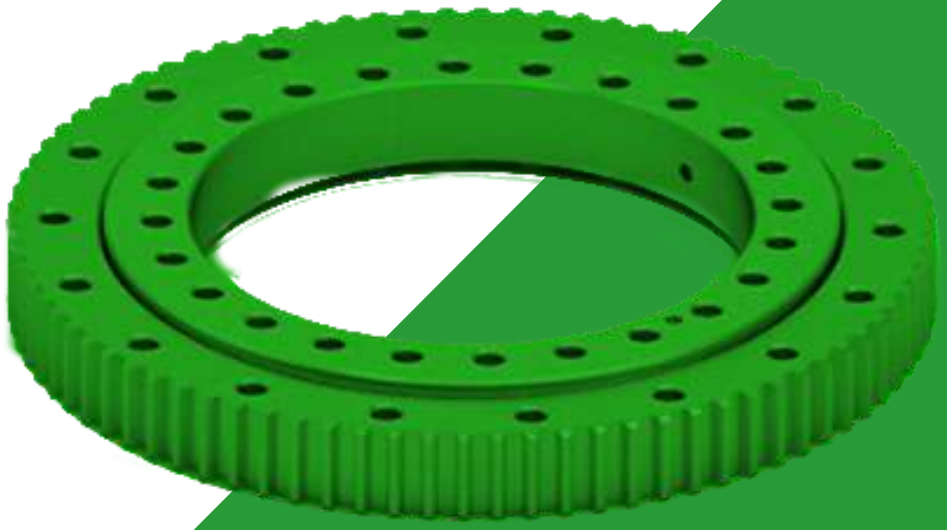

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