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SLEWING-RING

Installation and Maintenance Manual

Prior warning: The guarantee given by DSC and its manufacturer is given to the extent that the conditions of assembly, use, and maintenance of the slewing-rings are respected.
In order to obtain the best operating conditions and service life, the implementation and maintenance of a slewing-ring requires certain precautions or special operations during its installation and during its operation. The following manual will help you to meet these conditions.

CAUTION : In the case of a request for warranty, it is imperative to provide a certificate of conformity of assembly and the maintenance book of the machine

Strongly recommend: At all times the mounting surfaces of the upper and lower structure need to be checked on flatness before replacing any slewing-ring (new or used).

When in doubt about the flatness of the mounting surfaces, we advise you to use our casting system CW2418. This casting system will equalize all irregularities and discrepancies.

We can also check the mounting surfaces with the correct laser equipment.

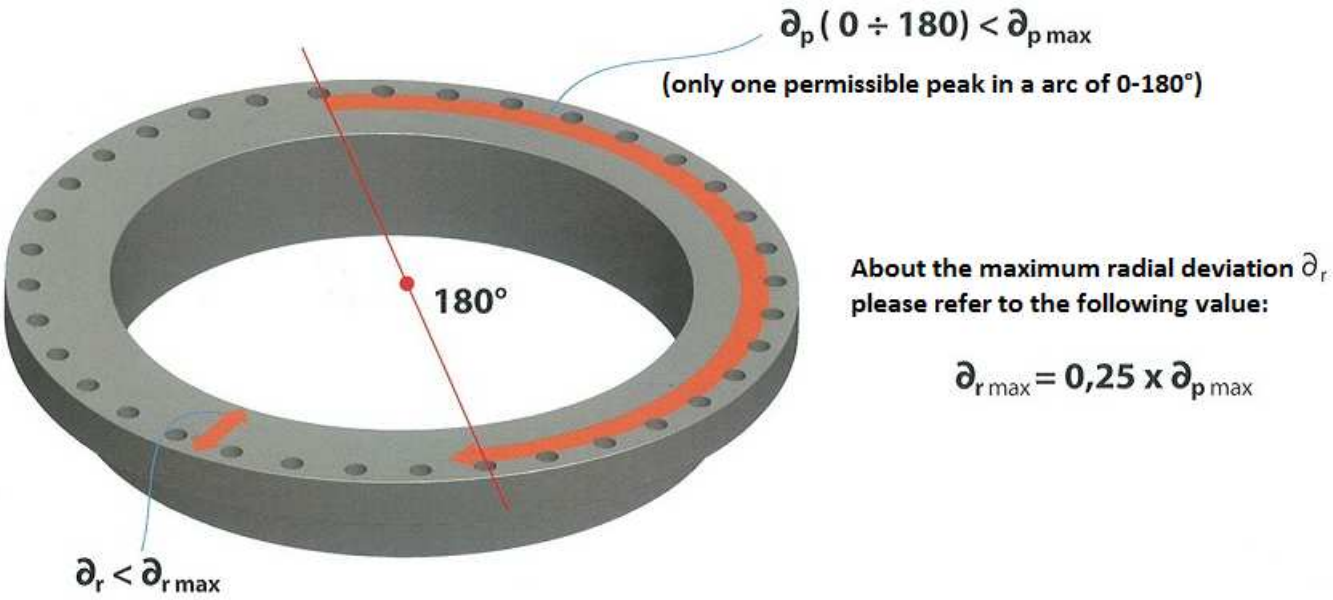
Laser measurement only on request and subject to invoicing

Flatness check

The slewing-ring, even though designed to resist to the maximum compressive and tilting loads, shows and intrinsic structural elasticity due to its own geometry, that is reduced section compared to a large diameter. The structural elasticity, when the bearing is fixed by bolts to the companion structure, involves an "adaptation" of the bearing itself to the flatness deviation of the mounting surface. These deviations, if not contained into the limits, may generate rotational problems. Below, the permissible flatness deviations $\partial p \; et \; \partial r$, measured along the circumferential and radial directions, valid for standard clearance bearings.

Bearing type	RACEWAY DIAMETER										
	<500	<750	<1000	<1250	<1500	<2000	<2500	<3000	<3500	<4000	<4500
	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)
BALL	0,10	0,12	0,15	0,17	0,19	0,22	0,25	0,30	0,35	0,40	0,50
ROLLER	0,07	0,09	0,11	0,13	0,15	0,17	0,19	0,23	0,25	0,30	0,35

Table of values of maximum circumferencial deviations ∂pmax depending on raceway diameter.



Preliminary operations

The preliminary operations to be performed before positioning the slewing-ringon companion structure are (please follow the succession):

1-Clean with chemical solvents and perform a visual check of the mounting surfaces of companion structure. Surfaces must be free from burrs or machining defects, for example in proximity of holes, or else welding or painting residues.

2-Check, with a gauge device or a laser measuring device, the flatness values of companion structure observing limit values listed on page 2. Ensure that the support structures comply with these requirements. If the above tolerances could not be met, then Epoxy type resins can be used instead of finishing-machining on the surfaces.

3-Sigots : When the loads along the radial axis are important, especially when the bearing is placed vertically, it is then mandatory to use the centerings provided for that purpose. The intercalative structural adhesive type LOCTITE 586 provides a good means to limit the relative displacements between rings and supports.

4-Remove the protective oil from the bearing surfaces and gear surfaces, using a chemical solvent. In order to avoid any sealing damages, don't put in contact the solvent with sealing..

Slewing-ring Installation

Installation :

1-In order to fasten the bearing to the companion structure it is firstly necessary to set the soft spot in the right position :

On the inner ring : the soft spot coincides with the filling plug, so the ring must be oriented with the filling plug at about 90° from the maximum operative load direction in order to minimize the stress in that raceway point (hardness gap).

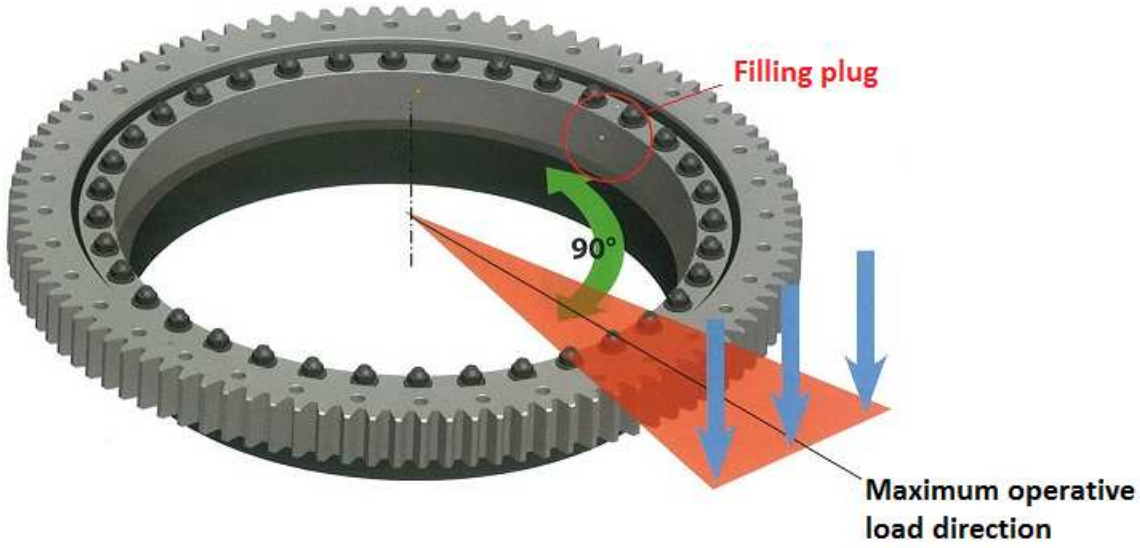
On the external ring : The soft spot coincides with a « S » engraved directly into the steel. So the ring must be oriented with the « S » at about 90° from the maximum operative load direction in order to minimize the stress in that raceway point (hardness gap).

2- Fix the ring gear on the second structure and if necessary, place the soft spot, marked by the letter "S", about 90 ° from the maximum load position. Then tighten the bolts.

3-Before fastening the bearing with bolts check the free rotation of the bearing : it must be without any tight spot. Then, tighten the bolts according to the instructions given on page 5.

Mark "S"

Filling plug's soft spot

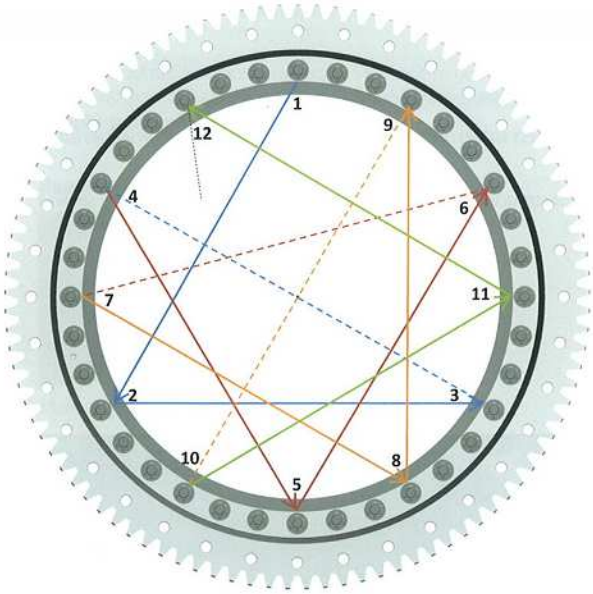


Bolts tightening

Strictly follow these rules :

1-Use dynamometric wrench or a hydraulic preloading tool.
2-Use only partial threaded bolts .
3-Use bolts, nuts and plane washers in Class 10.9,
the same of resistance catalogue graph.
4-Do not reuse bolts, nuts and washers .
5-Check tightening every 600 working hours.

Tightening sequence : We recommend to tight on three steps at 30-70-100% of below torque values. Check rotation during tightening.



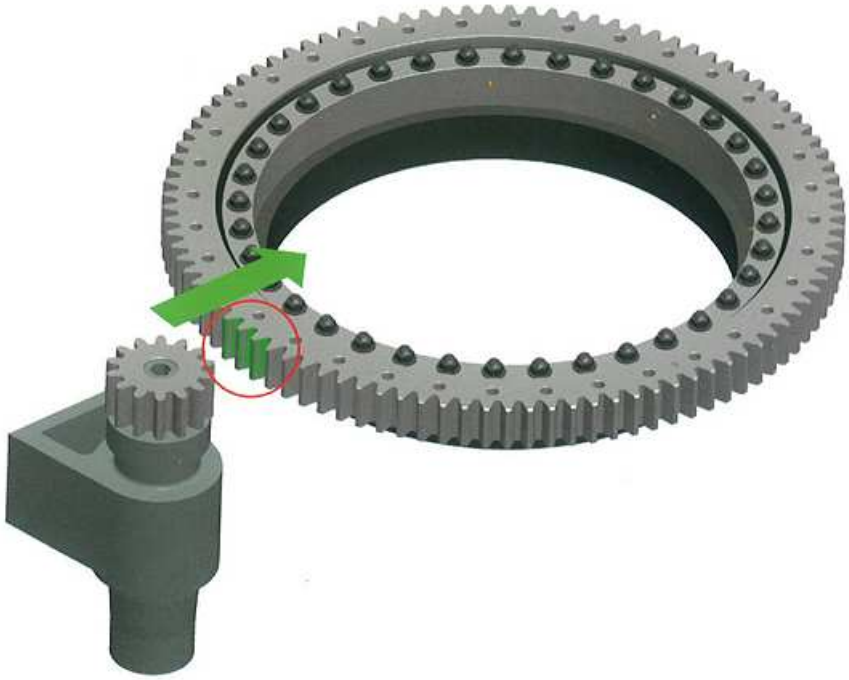
			Hydraulic W	Mechanical W
THREAD	As	FM (Q 10.9) V=90% $\mu G = 0.14$	MA (Q 10.9) $\mu K = 0.14$	MA (Q 10.9) $\mu K = 0.14$
	(mm²)	(N)	(Nm)	(Nm)
M10	58	38500	75	68
M12	84,3	56000	130	117
M14	115	77000	205	184
M16	157	106000	310	279
M18	192	129000	430	387
M20	245	166000	620	558
M22	303	208000	830	747
M24	353	239000	1060	954
M27	459	315000	1550	1395
M30	561	385000	2100	1890
M33	694	480000	2800	2520
M36	817	560000	3700	3330
M39	976	670000	4800	4320

Pre-tensioning (Fm) and fastening torque (Ma) values for bolts class 10.9 (at 90% of yield stress) with lightly lubricated thread.

Installation : continued

4-Now it's necessary to assemble the shaft to the structure. The fine position is determined by checking the backlash ∂f of the pinion teeth in the point of maximum eccentricity of the bearing gear, defined by the green painted teeth (see image below). This point represents the maximum run-out value of the gear outside the pitch diameter so, adjusting in this point the clearance pinion-bearing between 0.03÷0.04 the module value, the rotation in all other points will be ensured.

MODULE	MIN ∂f (mm)	MAX ∂f (mm)
4	0,12	0,16
4,5	0,13	0,16
5	0,15	0,2
6	0,18	0,24
8	0,24	0,32
10	0,3	0,4
12	0,36	0,48
14	0,42	0,56
16	0,48	0,64
18	0,54	0,72
20	0,6	0,8
22	0,66	0,88
24	0,72	0,96
25	0,75	1
28	0,84	1,12
30	0,9	1,2

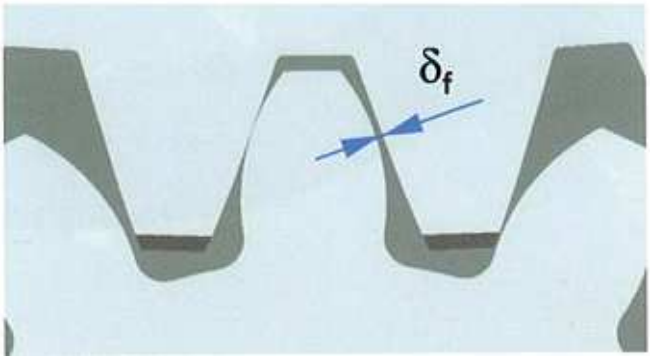


-The pinion should be located approximatively at 90° of the major axis.

-When several pinions are used, each one must be adjusted to the same conditions.

-Before running, lubricate the slewing-ring's teeth and of the pinion.

To check the setting of the pinion backlash use a thickness gauge :



Tests - inspections :

After final tightening of all fasteners :

✓ Rotate the ring for a least 3 turns

✓ Recheck the backlash value on the gear mesh over one full turn.

✓ Measure the total deflection under a known load. The checked point should be marked. It's advisable to register these values in a maintenance logbook specific to the machine.

Operating process :

✓ Place measuring device between the two rings as close as possible to the raceway on the main load axis : precision grade 0,1mm minimum.

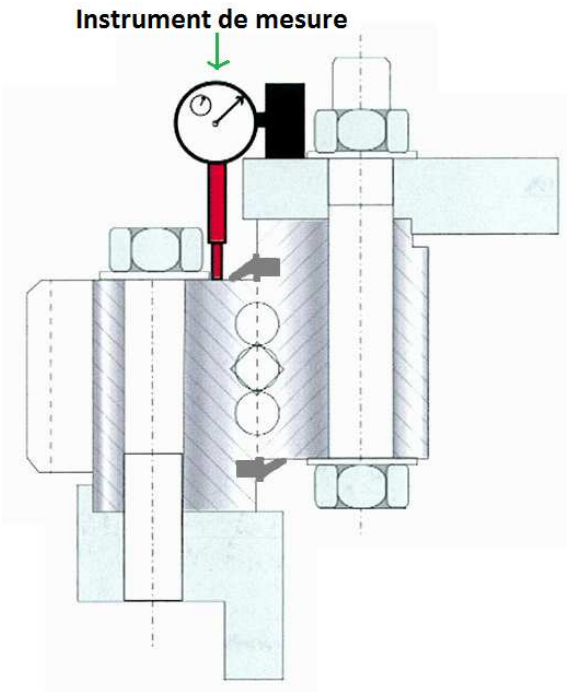
✓ Calibrate to zero, under a known load.

✓ 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 chassis and the fasteners elongation corresponding to the instrument position.



Raceway lubrication

The raceway lubrication may be conducted just after the installation of the bearing or in an intermediate phase. In any case an accurate re-greasing of the bearing must be performed before the machine start-up or before a long standstill time. It's an optimum condition that, during the machine activity, the sealing shall be always protected by a layer of fresh grease coming out from the raceway, in order to avoid external contamination.

The re-greasing operation must be performed :

✓ every 100 hours of machine activity (not only rotation time)

✓ with the bearing in continuous rotation

✓ using whole greasers

The operation is completed when a collar of fresh grease appears along the sealing of the bearing.

The re-greasing is also useful to evacuate the raceway from eventual internal moisture. If the bearing cannot rotate during this operation, the bearing design must include a major number of greasers. If necessary, lubricants can be mixed (check ΔT)

BRAND	Grease name (ΔT)
Agip	GR MU EP 2 -20°C to +110°C
ARAL	ARALUB HLP 2 -20°C to +130°C
bp	ENERGREASE LS-EP 2 -20°C to +130°C
Castrol	SPHEEROL EPL 2 -20°C to +120°C
FUCHS LUBRITECH	LAGERMEISTER EP 2 -20°C to +130°C

BRAND	Grease name (ΔT)
Esso	BEACON EP 2 -20°C to +120°C
Mobil	MOBILUX EP 2 -20°C to +120°C
Shell	ALVANIA EP 2 -20°C to +130°C
TOTAL	MULTIS EP 2 -25°C to +120°C
KLÜBER LUBRICATION	CENTOPLEX EP 2 -25°C to +130°C

Gear lubrication

La lubrification de la denture doit être faite en fonction de l'utilisation et de l'environnement dans lequel est montée la couronne d'orientation. Il est conseillé d'installer un système de lubrification automatique de la denture, par exemple à proximité du pignon, de manière à distribuer la graisse sur les zones concernées. Dans tous les cas une lubrification complète sur toute la denture doit être faite manuellement avant la mise en œuvre de la machine, avec un pinceau propre ou par pulvérisation, en enlevant l'excédent de graisse.

Les lubrifiants pour la denture de la couronne d'orientation et du pignon sont généralement :

BRAND	Grease name (ΔT)
Agip	GR MU EP 2 -20°C to +110°C
ARAL	ARALUB MKA-Z-1 -25°C to +180°C
bp	ENERGREASE LC2 -30°C to +140°C
Castrol	LMX -20°C to +120°C
FUCHS LUBRITECH	CEPLATTYN KG 10 HMF -10°C to +140°C

BRAND	Grease name (ΔT)
Esso	Multi Purpose grease (Molly) -20°C to +130°C
Mobil	MOBILGEAR OGL 461 -20°C to +120°C
Shell	MALLEUS OGH -10°C to +200°C
TOTAL	GARDREXA GR-1 AL -20°C to +200°C
KLÜBER LUBRICATION	GRAFLOSCON C-SG 0 ultra -30°C to +200°C

Greasing holes: radially or facially located, depending on design, these holes are generally tapped M10x 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 element has a blind tapped hole which is not a greasing hole!

RE-GREASING METHODS :

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

Greasing frequency :

Raceway and gear: the greasing frequency varies according to utilization and environment. We recommend re-greasing every 150 hours in normal usage. This frequency is to be reduced to 50 hours when the conditions of application are severe or if the environment is dusty or wet.

Greasing is required before and after a long idle period.

Re-grease every 6 months, while rotating, during prolonged idle periods.

Grease quantity :

The grease quantity is defined by the engineering department whenever a detailed bearing calculation is provided.

Approximate practical formula to determinate the minimum necessary quantity « Q » in cm^3 :

Q = 0,05/3 x D x H with :

D= raceway mean Ø of the bearing in mm

H= overall height of the ring in mm

In all cases, a light extrusion of new grease must appears at the protection seal lips.

GEAR : The grease must entirely cover the flanks of the pinion and of the ring gear whether applying by brush or spraying.

Duration life for a slewing-ring:

Many external factors to the slewing ring exert a very important influence on its service life. We can mention, in others:

-The geometric quality of the supports,
-The deformation of structures under loads,
-The climatic conditions and the environment,
-The quality of maintenance in service,
-The conditions of use: repeated exposure to shock, vibration or sudden or jerky movements, can significantly reduce the expected life.

These factors are statistically determined from a large number of experiments in each type of application. The standard parameters selected are the following:

- Duration of service : 6000 hours
- Work in a normal climatic environment
- Conventional application (non-specific)

Preventive maintenance

MONITORING PROTECTION:
Visual inspection helps to ensure the integrity of the seals:
• absence of excessive tension and tears,
• correct positioning,
• wear rate of the rubbing lip.
If necessary, replace the seal. After re-lubrication, dispose of used grease and check for pollution such as sand, coal, metal particles, etc.

MONITORING FIXATION:
As the slewing ring fixing bolts work primarily in fatigue, it is particularly important to check that the pre-load level required in the bolts is always maintained.
It is recommended to retighten the fixing bolts after the first two to four months of use, then to a systematic annual inspection.
If bolts are found loose an expertise is required. The necessary precautionary measures must be taken.
Some regulations require the replacement of fixing bolts every seven years or every 14,000 hours of work.
In all cases, refer to the standards and regulations in force for the application.

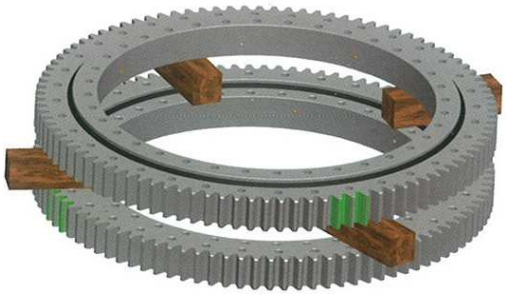
MONITORING ORIENTATION:
When cleaning before re-greasing the teeth:
• Take care to check the absence of any foreign body in the bottom of teeth, bearing and pinion.
• Check the regularity of the sprocket longitudinal extent over the full width of the slewing-ring and correct the alignment of the axles if necessary.
• Check the value of the backlash

MONITORING DEFLECTION UNDER LOAD:
The slewing-ring are delivered with an internal pre-load guaranteeing proper operation and optimum safety. During the life of the product, the pre-charge decreases and its evolution leads to a significant increase in deflection underload.
The slewing-ring must be replaced when this deflection is no longer compatible with proper operation and with the safety conditions required for the type of equipment used.

MONITORING ROTATION:
In order to be able to quantify the wear rate, it is necessary to know the deflection under load
• in new condition: J0.
• at the time of surveillance: J1.
These measurements are carried out under the same conditions after checking the fixing bolts.
The measured values are conveniently recorded in the machine control booklet.
Wear is the difference: $u = J1 - J0$.
• The crown should be monitored when: $u \geq J0$
• Its replacement should be considered when: $u \geq 1.5J0$ and is required from: $u \geq 2J0$

Handling & storage

Handling : Caution : when unpacking the slewing-ring take care not to cut the seals by removing the wrapping paper. Cut this paper, preferably on the outside diameters and not on the faces.

For an optimal handling of the bearing, use at least 3 eyebolts fixed to the bearings holes, equally spaced along the circumference. Don't exceed the chain angle over 120°.	
If the bearings must be piled, interpose wooden spacers between matching rings, in order to avoid damages on bearing surfaces.	

Storage:

Storage the bearings horizontally in thei own wooden crate or else on their pallet protected with cellophane, avoiding direct contact with the ground.	
Stock the bearings preferably in indoor dry areas at constant temperature, in any case repaired from weather agents and humidity. Check the protective oil coating every 6-12 months basing on stock conditions.