Installation, Lubrication and Maintenance Instructions

ThyssenKrupp Rothe Erde Large Diameter Bearing

Material No.: **36563320**
Drawing No.: **190.50.2039.100.62.1310**
Rothe Erde No.: **16-30609**

Customer: FWT Trade – Hilchenbach –

Application: Main bearing
Project No.: W8x - 2MW WEC
Specification: W1208-D0749-02-LORE-308-W2E-005-3-G

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1 Revision status

Revision status	Date	Issued by	Checked by	Modifications
D	26.08.2013	D. Wollschläger		new document

2 Installation, Lubrication and Maintenance Instructions for Bearings

2.1 Transport and Handling

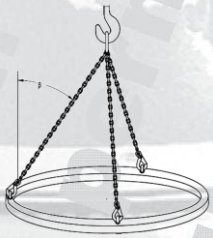
DANGER

Danger of life by overhead load

- Do NOT step underneath the load
- Use suitable slings
- Use suitable lifting devices

Like any other machine component bearings also require careful handling. Transport and storage is to be carried out only in horizontal position with suitable lifting tools / load securing devices. Bearing weight without crate is approx. 4250 kg. Radial impacts must be absolutely avoided.

If the bearing is delivered without transport bolts, the transport threads will be marked in color and/or provided with the information “lifting point”.
Attention: The chain angle ß may not exceed max. 60°.



Attention: To avoid raceway damage installed bearings have to be pivoted or turned at transport.

2.2 Storage:

Caution

Sensitive surface

- Do not open the packing with a sharp blade
- Surface may be damaged

The storage of the bearing has to be done in horizontal position.

The bearing outer surfaces are provided with a coating and the raceway system is filled with grease. Non-coated surfaces are treated with the anti-corrosion agent VCI 369 H/10 (P).

Maximum permissible storage periods:
approx. 6 months - roofed storage areas,
approx. 12 months - closed, temperature-controlled rooms (temperature > 12°C).

During storage or partly assembled bearings please note chapter: Lubrication / Notes

Longer storage periods will require a special packing!

2.3 Installation

2.3.1 Preparation of installation

CAUTION

Risk of skin irritation caused by preservative

- Safety gloves must be worn for removal
- Pay attention to the producer's data

If delivery is done with a transport cross bracing, this will have to be removed/dismounted before installation.

The installation of the bearing has to be done in the vertical axis of rotation!

If the contact surface is coated with an anti-corrosion agent, this will have to be removed. This can be done with an alkaline cleaner.

Attention: Prevent any cleaner from contacting the seals and from entering into the raceways! Do not paint the seals!
A flat contact surface free from grease and oil is required for the bearing installation.

The bearing contact surfaces have to be checked with regard to evenness deviation. Max. acceptable evenness deviation, acc. to DIN EN ISO 1101 is 0,1 mm. Over a sector of 180° this maximum value may only be reached once.

The max. acceptable deviation on roundness of bearing contact centering is 0,08. The required surface roughness of the contact surfaces is Ra 3.2 µm.

DANGER

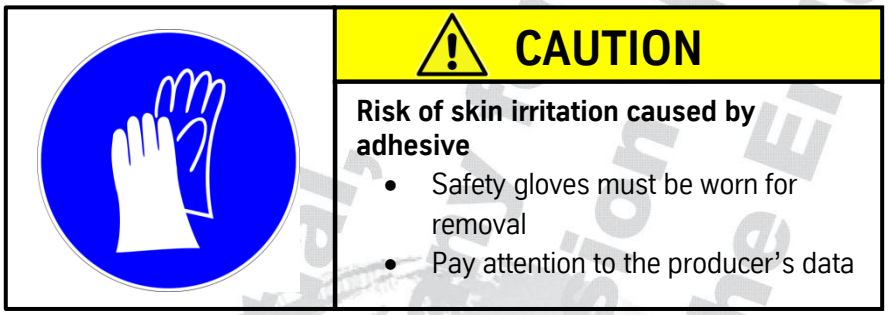
Entrapment hazard when putting the load down

- Location control before putting the load down
- Mind the staff

The raceways of the bearing are hardened without a soft spot. The positioning of the rings with the mating structure does not depend on the hardening. Possibly the bearing is marked with “TOP/OBEN”. This position has to be placed on 12 o´clock. Generally a double check with the drilling plan is necessary.

Possible enclosed supplies, seals, O-rings, grease nipples etc. have to be used.

2.3.2 Bolted connection



The radial loads will not be transmitted through the frictional bond of the bolts clamping force.
In order to prove a calculative evidence of an adequate safety against the frictional bond, **the contact surfaces have to be coated with Loctite 586**.

Inactive surfaces (inactive surfaces are for example: galvanized and coated surfaces, aluminum surfaces, non-metallic surfaces, etc.) must be pretreated with the activator “7471 ACTIVATOR T“ from Loctite. Loctite-586 must only be applied to the non-activated surface. If both sides are active, or if Loctite is applied onto the activator, premature curing may result.

Attention: Check the bolt lengths, in the loaded bolt section at least six free thread turns and the minimum bolt length must be assured.

The surface pressure under the bolt head or nut must not exceed the acceptable limit values.
When exceeding the surface pressure limit, suitable washers have to be used.

Information, see www.thyssenkrupp-rotheerde.com

2.3.3 Bolts outer ring

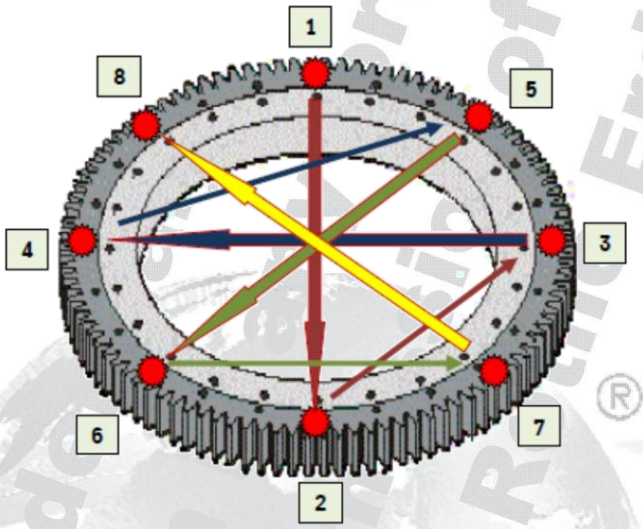
Use only bolts with threads rolled after heat treatment.

Connect the bearing with the companion structure and check the congruence of the bolt holes in the bearing with the bore holes of the companion structure! To aid bearing positioning 3 evenly distributed guide pins can be used.

With nonconfirmity the bearing could be slightly distorted /deformed.

Insert all bearing fixing bolts M 30 of strength class 10.9 hand-tight.

The bolts must be carefully pretensioned crosswise (see sketch) to 403,99 KN by means of a suitable tensioning equipment.
According to our calculations a minimum bolt tensioning force of 288,56 KN is required after tightening for the whole service life of the bearing.



Provide for a complete revolution after the 8th bolt crosswise. The pretension of the bolt having been tightened first is influenced by the tensioning of the further bolts. Thus it is necessary to provide for at least two revolutions.

2.3.4 Bolts inner ring

Use only bolts with threads rolled after heat treatment.

Connect the bearing with the companion structure and check the congruence of the bolt holes in the bearing with the bore holes of the companion structure! To aid bearing positioning 3 evenly distributed guide pins can be used.

With nonconfirmity the bearing could be slightly distorted /deformed.

Insert all bearing fixing bolts M 30 of strength class 10.9 hand-tight.

The bolts must be carefully pretensioned crosswise (see sketch) to 403,99 KN by means of a suitable tensioning equipment.
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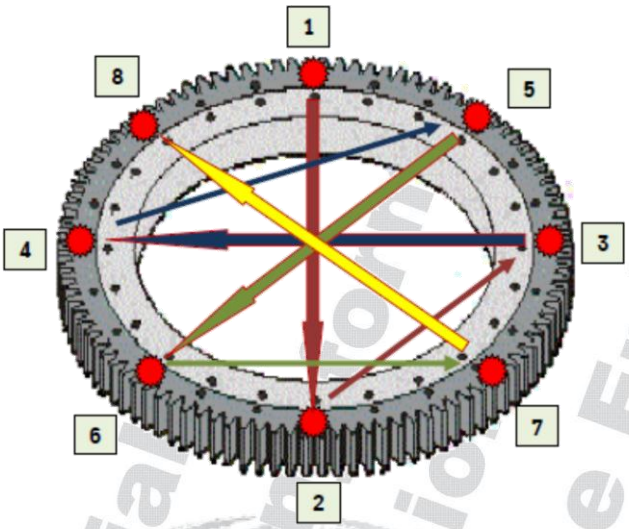


Provide for a complete revolution after the 8th bolt crosswise. The pretension of the bolt having been tightened first is influenced by the tensioning of the further bolts. Thus it is necessary to provide for at least two revolutions.

2.3.5 Operation temperature

The bearing is suitable for operating temperatures ranging from **-20 °C** to **50 °C**. This considers that all bearing rings will equally heat up or cool down respectively.

2.4 Lubrication:

2.4.1 Lubrication Raceway

Caution

Risk of skin irritation caused by lubricants

- Safety gloves must be worn when handling lubricants
- Pay attention to the producer's data

On delivery the bearing is adequately greased with the lubricant Stabyl EOS E 2 of the producer Fuchs.

To provide for an equal grease distribution in the bearing raceway system the use of an automatic lubrication system is recommended.
This has to be adjusted to pulsed intervals.

When automatic lubrication systems are in service the pumpability of the lubricant has to be confirmed by the lubrication system manufacturer.

Lubricant specific questions have to be clarified with the lubricant producer.
Note: Lubricants can be water-polluting and hazardous; the national laws and regulations have to be observed.

2.4.2 Re-lubrication quantities and intervals for raceway system

The first re-lubrication of the raceways is done immediately after installation.

ThyssenKrupp Rothe Erde recommends re-lubrication with the above mentioned grease.

When using automatic lubricating devices the re-lubrication quantity should be min. 77 milliliter a week. This quantity should be supplied to the raceway system within a year. During manual re-lubrication the mentioned quantity can be supplied in yearly intervals.

It has to be distributed acc. to the number of lubrication holes.
We recommend lubricating the bearing at each lubrication level at min. one lubrication hole.

For the outlet of the used lubricant several outlet holes are designed. The outlet of the lubricant is dependent on the respective turbine design /on the construction - / customer experience. The location and the number of the outlet holes which are used must be determined (adjustment process). A constant ventilation of the bearing must be given. For this all outlet holes can be used.

It must be assured that the re-greasing process will not result in permanent overpressure at the seals. Therefore, all grease outlet holes have to be permanently open.
Any emergence of surplus grease can be collected by standard collecting containers. These containers must be adequately dimensioned, provided with suitable ventilation holes and must be emptied or replaced in time. According to experience areas with larger grease leakage exist, here if necessary bigger containers should be provided.

2.4.3 Notes

Manuel re-lubrication is done during rotation or slewing of the bearing.

Before and after long periods of equipment disuse (approx. 3 months) a re-lubrication is absolutely required. This also applies to delayed commissioning and / or partly assembled equipment / bearings, where preservation of exposed metallic bearing surfaces and bolt holes must be performed immediately. The preservation must be regularly inspected, it must be assured, that no corrosion can occur.
Alternatively for partly assembled bearings a storage environment equivalent to long-term packaging can be created.

- preservation of the exposed metallic surfaces e.g. threads and holes/drillings
- Ensure that the relative humidity is ≤ 40 % (permanent temperature and humidity control).
- Temperature range -20° + 40°

With partly assembled bearings/slewing rings an inspection after 24 months by ThyssenKrupp Rothe Erde is meaningful.

In case of delayed commissioning and decommissioning a “rolling operation” as well as an adequate re-lubrication has to be assured to avoid raceway damage.

A test run is only possible with a sufficient moment load („slipp-stick effect“).

In view of the different parameters and operating conditions these can only be reference values.

2.5 Inspection

2.5.1 Bolt check

It must be assured that throughout the whole service life of the bearing an adequate high bolt pretension will be maintained. Due to practical experiences a retightening of the bolts is recommended for compensation of the settling phenomena.

For a bearing with surface coating we recommend a re-tightening of the bearing fixing bolts after approx. one day.

2.5.2 Check of the sealing system

The seals and the sealing system should be checked at least every 6 months.

If the bearing is equipped with a sealing compound at the ring segments these must be checked and if necessary reconditioned after consulting ThyssenKrupp Rothe Erde.

Any dirt/contamination must be removed.
If the seals are damaged they have to be replaced.
When cleaning the equipment/machine attention must be paid that no cleaning fluids will get into contact with the seals or penetrate the raceways.
All seals have to be sufficiently protected by the companion structure against mechanical damage, heavy dirt, direct sun rays and water jet, if needed by a dirt-deflector.

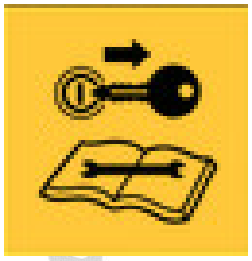
A leakage of 2 liter within 6 month is allowed and can be removed manual during the maintenance.

2.5.3 Check of the raceway system

Danger

Exceeding the maximum permissible wear rates involves the risk of accidents and danger of life

- When reaching the wear limits the machine must be put out of operation



Safety instructions

- While in operation it must be assured that the wear limits of the bearing will not be reached. With regard to further information (sketches / procedures) see www.thyssenkrupp-rotheerde.com.
- The resulting wear must be regularly determined and recorded.
- The procedure is included in the manual.
- In case of open questions ThyssenKrupp Rothe Erde must be contacted.

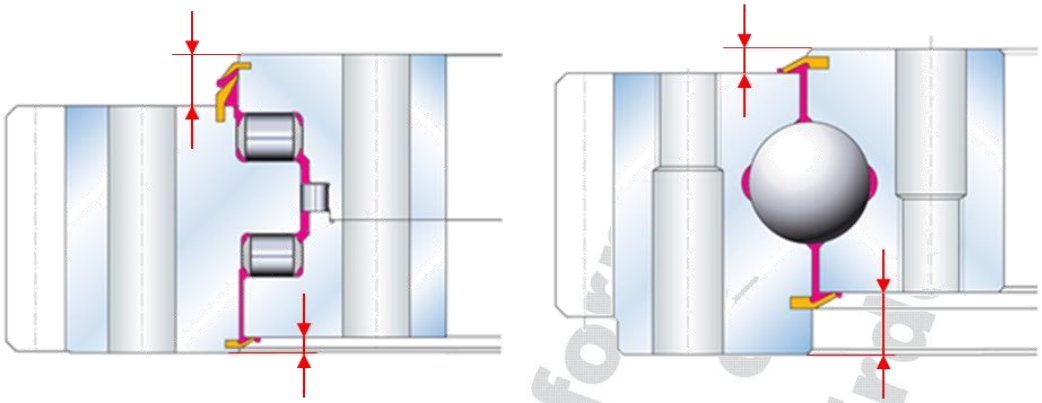
An assessment of the bearing raceway condition can be given by constant frequency analyses, temperature monitoring and regular lubricant analyses.

After a longer operating time the bearing clearances will increase.
The structural integrity can be ascertained by the following measurement.

During commissioning measuring points have to be defined at the bearing and at the companion structure and / or the distances of the bearing rings to each other have to be determined (see sketch).
In regular intervals these measurements have to be repeated and the results have to be documented.
The control measurements must always be made under the same load conditions and in the same positions.
The measured difference compared to the measurement made during commissioning gives the incurred bearing clearance.

Measurement method: **Reduction measurement**
Max. acceptable increase of bearing clearance 0,80 mm.

Using the example of a roller bearing / ball bearing:



Measuring points	Basic measurement	Control measurement	Control measurement
Measuring point 1			
Measuring point 2			
Measuring point 3			
Measuring point 4			
Inspector			
Date			
Signature			

While in operation it must be ensured that the wear limits of the bearing will not be exceeded!

2.5.4 Grease sampling / analyses

To give a more precise statement on the raceway condition adequate, lubricant samples should be taken out of the raceway system in addition to the wear measurements.
Both of these results taken together allow a more exact assessment of the wear condition and provide for further coordination and procedure.

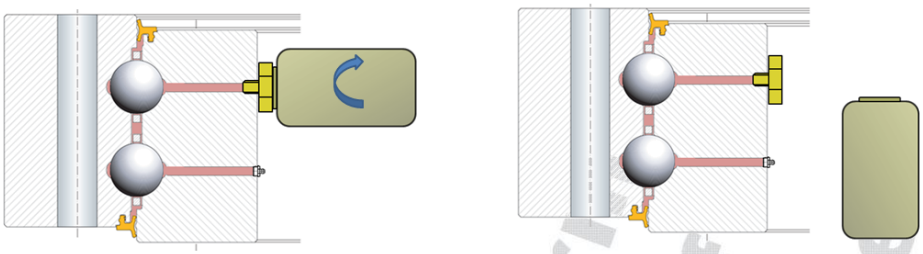
We suggest a yearly inspection procedure together with wear measurements.

The bearing has grease outlet holes.

We suggest an inspection procedure together with wear measurements as follows:

- Removal of the collecting tanks filled with used grease.
- Connect a new collecting tank.
- Close the collecting tank filled with used grease.
- Analysis of the grease sample by ThyssenKrupp Rothe Erde GmbH, D - 59555 Lippstadt, Beckumer Str. 87, Application Engineering & Service Dept.

Using the example of a ball bearing:



2.6 Disposal at the end of the useful life

Instruction

Disposal may involve environmental risks

- Follow the directives for waste disposal
- Mind the national laws

At the end of the useful life the bearing has to be dismantled. All lubricants, seals and plastic parts have to be disposed in accordance with the waste guidelines in force. Bearing rings and rolling elements have to be recycled.

2.7 ThyssenKrupp Rothe Erde Service assistance

For a continuous and undisturbed operation of our bearings we offer our following service:

Installation	Maintenance / Inspection	Reconditioning / Maintenance	Others
Judgement of the contact surfaces / laser measurement Bearing installation Reference measurements Commissioning	Wear measurements Check of bolts Lubrication analysis	Repair General overhaul	Trainings Technical support

For further information (sketches/procedures) we refer to:
www.thyssenkrupp-rotheerde.com

ThyssenKrupp Rothe Erde GmbH
Lippstadt, 26.08.2013