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LIEBHERR

General instructions

Slewing bearing

Installation

Lubrication

Maintenance

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Installation
Lubrication
Maintenance

Manufacturer

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04	Tip relief on the driving pinion added	6/17/2026

Revision history

Other applicable documents

Document	Use
Installation drawing	Supplementary to the instructions
Spare parts list	Determining and ordering spare parts

Other applicable documents

Preface

Basic instructions

This manual contains important instructions on how to safely, properly and economically operate the product.

Observing this manual will help reduce hazards and damage, minimize repair costs and down-times, and increase the reliability and service life of the product.

This manual does **not** replace the data, instructions and technical properties that can be found in the associated technical documents.

If you have received further information for the product, such as technical information (TI), service information (SI) or Reman documentation, this information must also be observed and included with the manual.

Keep this manual available in the vicinity of the product at all times.

This manual must be read by and used by everyone involved with operating or working on the product.

Print this manual only in color to emphasize important details in the figures.

Figures in this manual may deviate from the delivered type of product and serve as examples.

Upon delivery of the product as a spare part, the machine manufacturer must be contacted for installation, lubrication, and maintenance.

As soon as specific instructions are created for the product, the general instructions lose their validity.

Slewing bearings may only be opened by Liebherr employees or their authorized representatives. If slewing bearings are opened by other people, the warranty expires.

For reasons of better readability, only the masculine form of the word is used, without any intention to discriminate. The masculine form of the word here is representative of a gender-neutral designation. This basically means all gender identities.

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User guidance

Warning notices

	The warning sign warns of potential hazards. Follow all of the measures labeled with this warning sign to prevent injury or death.
---	--

Warning sign

The gradation of the warnings is defined by the following signal words:

- **DANGER**
- **WARNING**
- **CAUTION**
- **ATTENTION**

Symbol	Signal word	Meaning
	DANGER	Identifies an immediately hazardous situation that will lead to death or serious injury if it is not avoided.
	WARNING	Identifies a hazardous situation that could lead to death or serious injury if it is not avoided.
	CAUTION	Identifies a hazardous situation that could lead to minor or moderate injury if it is not avoided.
	ATTENTION	Identifies a hazardous situation that could lead to property damage if it is not avoided.

Warning notices

Other symbols

Symbol	Meaning
	Note Useful information and tips.
	Request for action Perform action step.
	Prerequisite Prerequisite for subsequent action steps.

Symbol	Meaning
	Result Result of one or more action steps.
	Enumeration Individual point of a list.
	Text link Hyperlink to graphic, table, footnote or text passage.

Other symbols

Prohibition signs

Symbol	Meaning
	Access for unauthorized persons prohibited.
	No access for people with pacemakers or implanted defibrillators.
	Do not touch.
	No heavy loads.
	No access for persons with metal implants.
	Entering the area is prohibited.

Prohibition signs

Warning plates

Symbol	Meaning
	Warning against explosive substances
	Warning against magnetic field
	Warning against obstacles on the ground
	Warning against electrical voltage
	Warning against suspended load
	Warning against hot surface
	Warning against automatic startup
	Warning against sharp object
	Warning against hand injuries

Warning plates

Mandatory signs

Symbol	Meaning
	Observe the instructions for use.

Symbol	Meaning
	Ground before use.

Instructional signs

Protective equipment

Symbol	Protective equipment	Use case
	Hearing protection	Noise
	Eye protection	Splinters, splashes, compressed air, aerosols
	Face protection	Splinters, splashes, compressed air, aerosols
	Head protection	Falling and flying parts
	Hand protection	Dirt, splinters, splashes, aerosols, hazardous substances, hot and cold parts, sharp edges
	Foot protection	All activities
	Breathing protection	Vapors, aerosols, dust
	Protective clothing	Dirt, splinters, splashes, aerosols, hazardous substances, hot and cold parts
	Hair net	All activities

Protective equipment

Contact

Further information on the product can be obtained from:

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Postfach 1664

88386 Biberach/Riß

Tel.: +49 73 51 41-49 99

E-mail: CustomerService.cob@liebherr.com

<https://www.liebherr.com>

Have the following information ready when purchasing spare parts:

- Information from the identification plate of the product
- Item code and designation of spare part

Have the following information ready in case of faults:

- Information from the identification plate of the product
- Working hours of the product
- Operating conditions of the product
- Type and degree of fault
- Possible cause of the fault
- Point in time and circumstances of the fault
- Maintenance work performed on the product
- Optional: Reports for the tilting clearance test or lowering measurement
- Optional: Reports for the grease analysis
- Optional: Report for verification tooth flank backlash

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1 Product description

1.1 Nomenclature

KUD 00855 - 025 V A 15 - 900 - 000

1
2
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BA_GWL_042

Fig. 1: Example representation: Nomenclature

- | | |
|---|--|
| 1 Product group
2 Raceway diameter (mm)
3 Rolling element diameter (mm)
4 Structural shape | 5 Gear teeth
6 Internal designation
7 Internal designation
8 Internal designation |
|---|--|

Possible product groups:	
DKD	Wire ball bearing
DRD	Wire roller bearing
KED	Tapered roller slewing ring
KUD	Ball slewing ring
RKD	Roller-ball-slewing ring
ROD	Roller slewing ring (cylinder roller)
ZAK	Gear ring

Tab. 1: Product group

Possible structural shapes:	
Z	Double row
D	Triple row
V	Four-point bearing, single row
W	Four-point bearing, double row

Tab. 2: Structural shape

Possible gear teeth forms:	
O	Without gear teeth
J	Internal teeth
A	External teeth

Tab. 3: Gear teeth

2 Safety

2.1 Intended use

The product is intended exclusively for installation and operation as a slewing bearing.

All other uses or conversion of the product is prohibited.

For intended use, observe the following points:

- Information in these instructions
- Relevant standards, guidelines and regulations
- Recognized rules of technology

Only use the product for the agreed technical purpose for which it was designed. Do **not** operate the product with outputs, torques, speeds or external loads that exceed the mechanical design. Have all activities on the product performed only by qualified professional personnel.

The manufacturer is **not** liable for damage caused by **improper** use.

2.2 Qualification of personnel

2.2.1 Personnel requirements

- Have reached the legally required minimum age.
- Are physically and mentally able to safely work on the product:
 - Sufficient eyesight
 - Sufficient hearing ability
 - Quick reaction time
 - Are able to assess distance, height, and spacing.
- Are **not** subject to any physical or mental impairments that diminish any of the prescribed requirements.
- Are **not** under the influence of alcohol.
- Are **not** under the influence of drugs.
- Are **not** under the influence of medication.

2.2.2 Responsibilities of personnel

- Wear personal protective equipment.
- Regular cleaning and care of the personal protective equipment
- Immediate replacement of damaged parts of personal protective equipment

2.2.3 Definition of personnel

Personnel	Definition	Symbols in the maintenance plan	Service level
Maintenance personnel	Maintenance personnel are people who have been instructed and trained in the assigned tasks, possible dangers, necessary protective equipment and protective measures.	■ ● ✦	SL1

Personnel	Definition	Symbols in the maintenance plan	Service level
Mechanical specialist	Mechanical specialists are people who, due to their qualifications, experience and knowledge of the relevant standards, regulations and provisions, are able to work on the product and independently recognize and avoid possible dangers.		
Qualified electrician	Qualified electricians are people who, due to their qualifications, experience and knowledge of the relevant standards, regulations and provisions, are able to work on the product and independently recognize and avoid possible dangers. Electricians must be qualified to handle electrical voltage, high voltage and control and automation systems.		
Authorized specialist personnel	Authorized specialist personnel are people trained and authorized by Liebherr-Components Biberach GmbH to work on the product (→ Contact, p. 12).	□ ○ ✦	SL2

Tab. 4: Definition of personnel

2.3 Avoiding dangers

- Observe national and regional regulations on safety and accident prevention.
- Observe the technical data.
- Ensure the personnel have the required qualifications.
- Only qualified electricians perform electrical work in accordance with applicable safety regulations and rules.
- Assemble labeling permanently and visibly.
- Observe the labeling.
- Use personal protective equipment.
- Observe the servicing intervals.
- Only test and operate the product with protective equipment.
- Tighten screws with the permissible pretension force or permissible tightening torque.
- Use only permissible tools.
- Only use operating materials and lubricants approved by Liebherr-Components Biberach GmbH.
- Observe the manufacturer's instructions for the operating materials and lubricants.
- Hoist components over 10 kg (22.05 lb) only using suitable lifting accessories and lifting gear.
- Observe the manufacturer's instructions for the lifting accessories and lifting gear.
- All lifting accessories and lifting gear must be tested and used in an undamaged state only.
- Warranty claims are only valid if original parts are used.
- Only allow personnel with appropriate qualifications to work on the product.
- Use hearing protection during operation of the product.
- Make sure that personnel are **not** exposed to vibrations or oscillation hazards during operation.
- Transport the product properly.
- Record all maintenance.
- Retain all records.
- Observe applicable guidelines of the insurance company.
- Any work methods that could endanger safety are prohibited.

- Do **not** remove protective covers.
- Do **not** touch live components.
- Do **not** touch hot surfaces.
- Observe the following when cleaning:
 - Use lint-free cleaning rags.
 - Do **not** use a high-pressure cleaner or steam jet.
 - Do **not** damage seals with cleaning agents.
 - Make sure that water or cleaning agent does **not** enter into the bearing raceway.
- Do **not** touch rotating components.

Safety

Avoiding dangers

3 Transport and storage

3.1 Delivery

3.1.1 Delivery condition

3.1.1.1 Bearing raceways

The bearing raceways of the slewing bearing are filled with lubricating grease in the delivery condition by default.

The lubricating grease used can be found in the installation drawing.

3.1.1.2 Corrosion protection

Slewing bearings are preserved with temporary corrosion protection by default.

The gear teeth of the slewing bearing are not greased in the delivery condition. Gear teeth are treated with corrosion protection at the factory.

3.1.2 Checking the product after delivery

- ▶ Check the delivery for completeness.

If the delivery is incomplete:

- ▶ Report missing parts to Liebherr-Components Biberach GmbH.
- ▶ Check the delivery for transport damage.

If transport damage is present:

- ▶ Report any transport damage to Liebherr-Components Biberach GmbH.

3.2 Transport

3.2.1 Preparing for transport

- ▶ Observe the legal regulations.
- ▶ Observe the weight, dimensions and center of gravity of the product.
- ▶ Observe the manufacturer's instructions for the lifting accessories and lifting gear.
- ▶ Observe the maximum load capacity when selecting lifting accessories and lifting gear.
- ▶ All lifting accessories and lifting gear must be tested and used in an undamaged state only.
- ▶ Hoist the product only at permissible slinging points, where such points have been specified.
- ▶ Ensure a suitable transport route for the product.
- ▶ Protect the product against moisture during transport.
- ▶ Avoid radial impacts.

If multiple slewing bearings are transported stacked on top of each other:

- ▶ Make sure that **no** additional raceway load acts on lower slewing bearings.

3.2.2 Transporting the product



DANGER

Falling load!
Death, bodily injuries.

- ▶ Remain only outside the danger zone.
 - ▶ Use suitable lifting accessories and lifting gear.
 - ▶ Hoist the product only at permissible slinging points.
 - ▶ Observe the center of gravity of the product.
-



WARNING

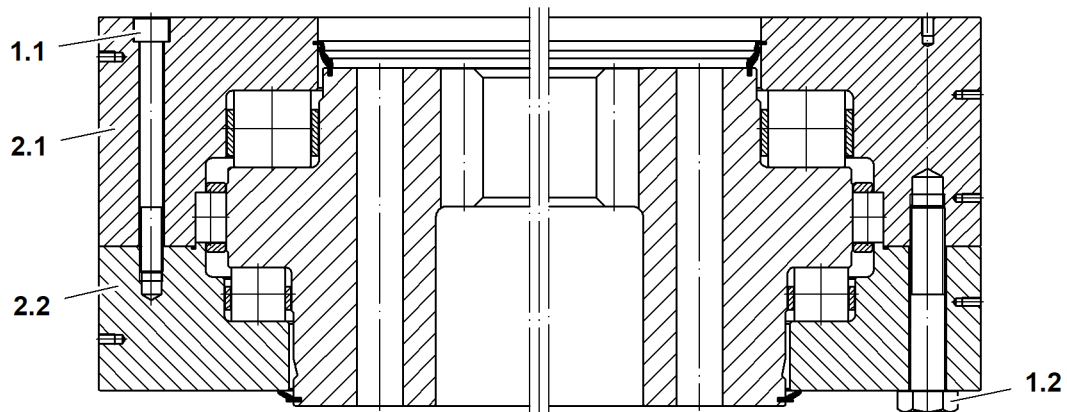
Improper setting down of the product!
Death, bodily injury.

- ▶ Make sure that persons are **not** injured.
-

NOTICE

Exceeding of the towing capacity!
Damage to the product.

- ▶ Hoist the product only at slinging points.
-



BA_GWL_040

Fig. 4: Example representation of locking screws

1 Locking screw

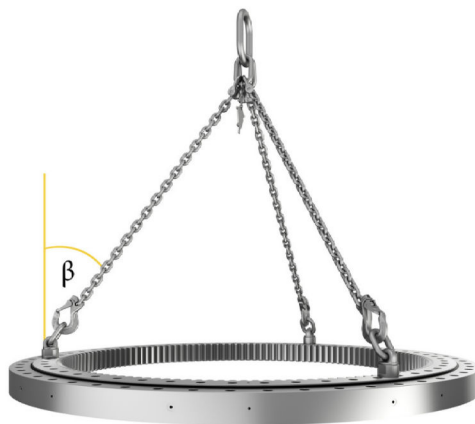
2 Single ring

If several single rings **2** are screwed together:

- After a longer period of operation, check the locking screws **1** of the single rings **2** for corrosion.

If the locking screws **1** are corroded:

- Secure the single rings **2** against disassembly.
- Single rings are assembled.



BA_GWL_001

Fig. 5: Product suspension

β Angle of inclination

- Check the slinging points, suitable lifting accessories and suitable lifting gear for damage.
- Take the quantity and position of the slinging points from the drawing.
- Observe the provisions of the respective lifting accessory.
- Screw in the lifting accessory completely at all slinging points.
- Make sure that lifting accessory rest flat on the contact surface.
- Assemble lifting gear to all lifting accessories.
- Ensure that the angle of inclination β is $\leq 45^\circ$. Select chain lengths accordingly.
- Transport the product.
- Set down the product.

3.2.3 Returning the product

- ▶ Return the product only upon agreement with Liebherr-Components Biberach GmbH.



WARNING

Improper use of cleaning agents!
Death, bodily injuries.

- ▶ Observe the manufacturer's instructions for the cleaning agent used.
 - ▶ Make sure that only specialists carry out cleaning work.
 - ▶ Use personal protective equipment (→ [Protective equipment, p. 11](#)).
-

If a return has been agreed upon:

- ▶ Clean the product.
- ▶ Dry the product.



WARNING

Improper use of corrosion protection agents!
Death, bodily injuries.

- ▶ Use personal protective equipment (→ [Protective equipment, p. 11](#)).
 - ▶ Observe the manufacturer's instructions for the corrosion protection agent used.
-
- ▶ Treat bare surfaces with corrosion protection agent. Use protective equipment (→ [User guidance, p. 8](#)).
 - ▶ Pack the product.
 - ▶ Return the product.

3.3 Storage

3.3.1 Storing the slewing bearing with standard packaging

Slewing bearings are treated with corrosion protection agents by default. Preservation with corrosion protection agents enables storage of up to 6 months in covered spaces.

In enclosed spaces with a temperature greater than 12 °C (54 °F), the storage time is approximately 12 months.

Storage outdoors is **not** permissible.

- ▶ Make sure that the slewing bearing is always stored horizontally.

3.3.2 Storing the slewing bearing with long-term packaging

Long-term storage is when the slewing bearing is stored for more than twelve months. Special packaging is required for long-term storage.

- ▶ Coordinate the special packaging and special measures for long-term storage with Liebherr-Components Biberach GmbH.
- ▶ Coordinate the maximum storage period with Liebherr-Components Biberach GmbH.

4 Installation

4.1 Preparing for installation

Make sure that the following prerequisites have been met:

- ❑ The slewing bearing is only installed by professional personnel in accordance with applicable safety regulations and rules.
- ❑ Connecting surfaces are free of lubricating grease, oil, paint, welding beads and other contaminants and unevenness.
- ❑ The slewing bearing is undamaged.
- ❑ The connection construction is designed for slewing bearing.
- ❑ The connection construction is as torsion-resistant as possible.
- ❑ The slewing bearing is completely supported by the connection construction.
- ❑ The hole patterns of the connecting surfaces and slewing bearings are congruent.
- ❑ Lubricating points and grease extraction points of the slewing bearing are easily accessible in installed condition.
- ❑ Tightening and clamping of the fastening bolts with permissible tools is possible without hindrance during installation and in later operation.
- ❑ Plating is permanently and visibly attached.
- ❑ The flatness tolerance is **not** exceeded in unloaded condition (→ tab. 5, p. 31) (→ tab. 6, p. 32).
- ❑ The maximum value of the flatness deviation occurs only once on a sector of 180°. The progression may only rise or fall evenly.
- ❑ The connection construction is dimensionally stable after welding work.
- ❑ Connecting surfaces are neither damaged nor deformed by subsequent machining processes.

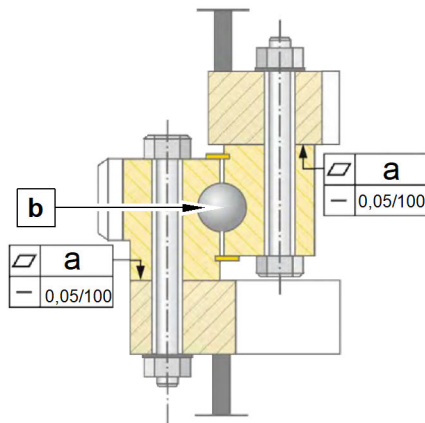


Fig. 6: Checking the flatness of connecting surfaces

a Flatness tolerance according to the table **b** Raceway diameter

The flatness may not exceed 0.05 mm (0.00197 in) over a measuring length of 100 mm (3.937 in) , measured at any point of the bearing surface.

Raceway diameter (b)	Flatness tolerance (a) according to DIN EN ISO 1101
Up to 1000 mm (3.28 ft)	0.15 mm (0.0059 in)
Over 1000 (3.28) to 1500 mm (4.92 ft)	0.20 mm (0.0079 in)

Raceway diameter (b)	Flatness tolerance (a) according to DIN EN ISO 1101
Over 1500 (4.92) to 2000 mm (6.56 ft)	0.23 mm (0.0091 in)
Over 2000 (6.56) to 2500 mm (8.2 ft)	0.25 mm (0.0098 in)
Over 2500 (8.2) to 3500 mm (11.48 ft)	0.30 mm (0.0118 in)
Over 3500 (11.48) to 4500 mm (14.76 ft)	0.35 mm (0.0138 in)
Over 4500 (14.76) to 6000 mm (19.69 ft)	0.40 mm (0.0157 in)
Over 6000 (19.69) to 8000 mm (26.25 ft)	0.50 mm (0.0197 in)

Tab. 5: Flatness tolerance for four point bearing

Raceway diameter (b)	Flatness tolerance (a) according to DIN EN ISO 1101
Up to 1000 mm (3.28 ft)	0.10 mm (0.0039 in)
Over 1000 (3.28) to 1500 mm (4.92 ft)	0.13 mm (0.0051 in)
Over 1500 (4.92) to 2000 mm (6.56 ft)	0.15 mm (0.0059 in)
Over 2000 (6.56) to 2500 mm (8.2 ft)	0.18 mm (0.0071 in)
Over 2500 (8.2) to 3500 mm (11.48 ft)	0.21 mm (0.0083 in)
Over 3500 (11.48) to 4500 mm (14.76 ft)	0.25 mm (0.0098 in)
Over 4500 (14.76) to 6000 mm (19.69 ft)	0.30 mm (0.0118 in)
Over 6000 (19.69) to 8000 mm (26.25 ft)	0.40 mm (0.0157 in)

Tab. 6: Flatness tolerance for roller bearing

4.2 Cleaning the bearing surfaces



WARNING

Improper use of cleaning agents!
Death, bodily injuries.

- ▶ Observe the manufacturer's instructions for the cleaning agent used.
- ▶ Make sure that only specialists carry out cleaning work.
- ▶ Use personal protective equipment (→ [Protective equipment, p. 11](#)).



CAUTION

Improper removal of preservative!
Bodily injuries.

- ▶ Use personal protective equipment.
- ▶ Observe the manufacturer's instructions for the preserving agent used.



Note

Liebherr-Components Biberach GmbH recommends cleaning unpainted bearing surfaces with acetone mixtures.

- ▶ Depending on the existing surface coating, select a suitable cleaning method and cleaning agent.
- ▶ Check the compatibility of the cleaning agent on a small area of the painted surface.
- ▶ Make sure that no cleaning agent gets onto the seals or into the bearing raceways.
- ▶ Remove temporary corrosion protection on the bearing surfaces of the slewing bearing before assembly.

4.3 Attaching and aligning the slewing bearing

Make sure that the following prerequisite has been met:

- ❑ Bearing surfaces of the slewing bearing and the connection construction are cleaned of oil, operating materials, soiling and care products. Do not use aggressive cleaning agents. Use lint-free cleaning rags.



DANGER

Falling load!

Death, bodily injuries.

- ▶ Remain only outside the danger zone.
- ▶ Use suitable lifting accessories and lifting gear.
- ▶ Hoist the product only at permissible slinging points.
- ▶ Observe the center of gravity of the product.



WARNING

Improper setting down of the product!

Death, bodily injury.

- ▶ Make sure that persons are **not** injured.
- ▶ Observe the provisions for the suspension of the slewing bearing (→ [3.2.2 Transporting the product, p. 26](#)).

Due to the manufacturing process, there is a small unhardened zone, the hardness slip, in the inductive hardening of the rolling element raceway. The hardness slip is marked with the symbol **S** on the front of the slewing bearing.

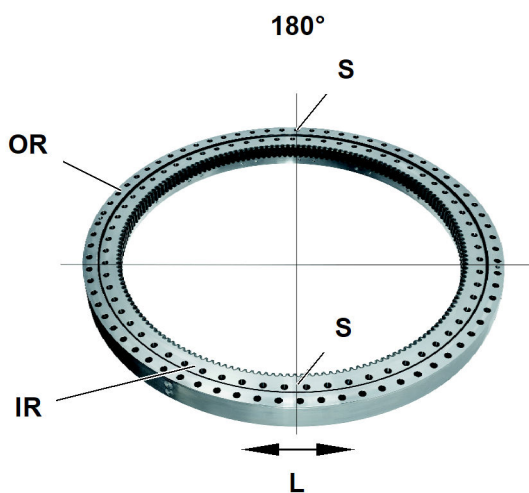


Fig. 7: Example representation of the arrangement of hardness slip points

OR Outer ring

IR Inner ring

L Load direction

S Hardness slip

The figure shows an example of the common arrangement of hardness slip points (→ [fig. 7, p. 34](#)).

- ▶ Position the hardness slip point on the bearing ring with the point load outside the main load zone.

BA_GWL_021

If the main load zone is known for a bearing ring with a circumferential load:

- Position the hardness slip point outside the main load zone.

Additional information can be found in the supplied drawing.

- In case of doubt, contact the service personnel of Liebherr-Components Biberach GmbH ([→ Contact, p. 12](#)).

If the slewing bearing is set on a connection construction:

- Make sure that the slewing bearing rests evenly in unloaded condition.

4.4 Bolted joint

Make sure that the following prerequisites have been met:

- ❑ The required tightening tools are available.
- ❑ Uncoated bearing surfaces of the connection construction and slewing bearing are metallurgically bright and free of grease.
- ❑ Bearing surfaces of the connection construction and slewing bearing are free of temporary corrosion protection agent.
- ❑ The specified quantity of screws are available.
- ❑ The screws correspond to specified diameters.

Unless otherwise agreed, screws with a strength rating of 10.9 are used.



DANGER

Improper tightening of screws!
The bolted joint loosens.
Death, bodily injury.

- ▶ Use a calibrated tool.
- ▶ Tighten screws crosswise with the permissible tightening torque or preload force.
- ▶ Make sure that the component is pressed evenly against the connection construction.
- ▶ Check the bolted joint at regular intervals.

		Minimum screw depth					
Screw strength rating		8.8	8.8	10.9	10.9	12.9	12.9
Thread fineness d/P		< 9	≥ 9	< 9	≥ 9	< 9	≥ 9
Connection construction / nut material	S235	1.0 x d	1.25 x d				
	S355, C45N	0.9 x d	1.0 x d		1.2 x d		1.4 x d
	42CrMo4+QT, C45V	0.8 x d	0.9 x d		1.0 x d		1.1 x d

Tab. 7: Minimum screw depth for threads for medium tolerance class after calculation according to VDI 2230 sheet 1

d = outside diameter of thread in mm for screws with ISO standard metric thread

P = thread pitch in mm

- ▶ Insert all screws in corresponding borings.
- ▶ Screw the screws into the threaded holes, taking into account the minimum screw depth.

Liebherr-Components Biberach GmbH recommends a clamping length of more than 5 x d.

If the screws cannot be screwed in smoothly over the entire screw depth:

- ▶ Clean or trim the thread.

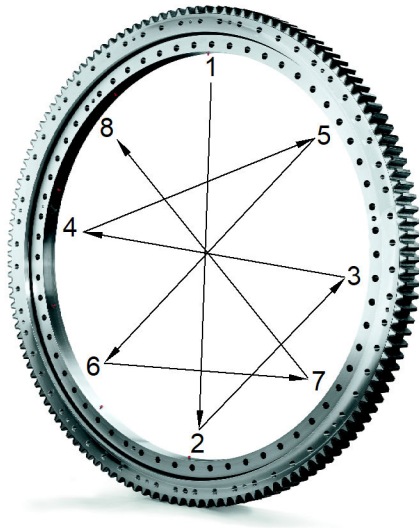


Fig. 8: Tightening the screws

The table in the appendix provides reference values for tightening torque and preload force. (→ 7.1.1 Shaft bolts, p. 63) The specified values apply to a friction coefficient of $\mu = 0.14$ in the thread and $\mu = 0.14$ between the head support and connecting surface. Depending on the lubrication, the actual values can deviate significantly from the table values.

When using clamping cylinders, Liebherr-Components Biberach GmbH recommends threads with large play in accordance with DIN 2510-2, since threads with small play can cause the nut to stick during unscrewing.

The preload forces and tightening torques for the assembly of the slewing bearing to the connection construction are to be specified by the machine manufacturer.

- ▶ Tighten the first 8 screws crosswise to the required tightening torque.
- ▶ Tighten remaining screws circumferentially to the required tightening torques.

The pretension of the screws tightened first is influenced by the tightening of the other screws.

- ▶ Tighten the screws in the second round to the required tightening torques.

The interface pressure is roughly calculated according to VDI 2230:

$$\delta = 1.1 \cdot F_M / A_p$$

F_M = assembly preload force

A_p = screw head bearing surface or nut bearing surface

Bearing surface A_p is dependent on the type of selected screw.

- ▶ Calculate the interface pressure.
- ▶ Compare the interface pressure with the "Interface pressure for screw head supports" table. (→ tab. 8, p. 37)

Bearing surface material	Interface pressure [N/mm ²]
S235	490
S355	760
42CrMo4+QT	1070 (Based on R _m , LN 180)
Cq45	770

Bearing surface material	Interface pressure [N/mm²]
GJS 400	600

Tab. 8: Interface pressures for screw head supports (reference values according to VDI 2230 sheet 1)

If the interface pressure is exceeded:

- Increase the screw head bearing surface. Use washers.

4.5 Tip relief on the driving pinion

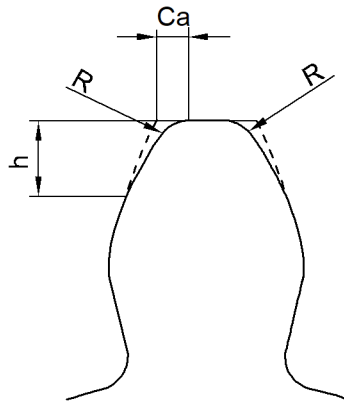


Fig. 9: Tip relief on the driving pinion

Ca Tip relief
R Edge radius

h Height of the tip relief

When using Liebherr-drives, the tip relief **Ca** is coordinated with the gear teeth of the slewing bearing.

When using other drives, a tip relief **Ca** in the form of an involute is recommended.

The edge radius **R** must merge smoothly into the head flange without forming a sharp edge.

The calculation is based on the m module:

$$C_a = 0.01 \cdot m$$

$$h = 0.4 - 0.6 \cdot m$$

$$R = 0.1 - 0.15 \cdot m$$

BA_GWL_047

4.6 Setting the tooth flank backlash



WARNING

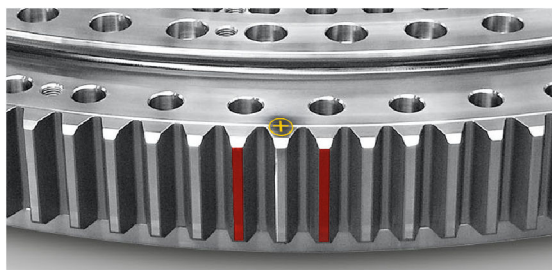
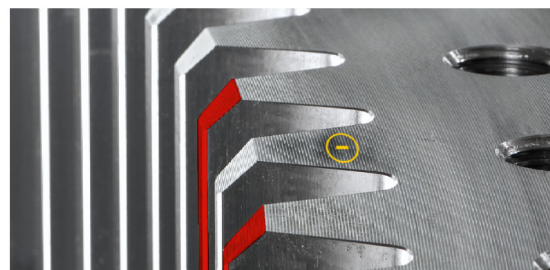
Exposed gear teeth!
Death, bodily injuries.

If the product is turned:

- ▶ Do **not** reach into the effective area of the gear teeth.

By default, when the bearing is mounted, the tooth flank backlash should not fall below the minimum value of **0.03 x module** or exceed the maximum value of **0.06 x module** at the point of the greatest eccentricity of the gear teeth.

The point of the greatest eccentricity is marked with a “+” or “-” symbol.



BA_GWL_005

Fig. 10: Stamping of the slewing bearing

+ Symbol with external teeth

- Symbol with internal teeth

With external teeth, the symbol + marks the point of the smallest play of the gear teeth.

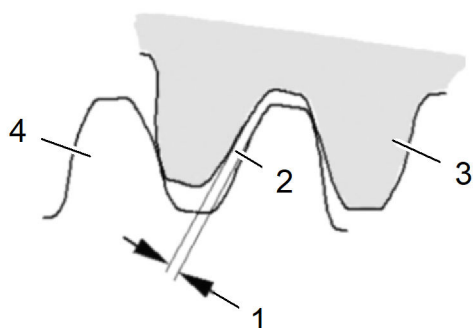
With internal teeth, the symbol - marks the point of the smallest play of the gear teeth.

The teeth to the left and right of the point of the greatest eccentricity are marked with red color.

- ▶ Set the tooth flank backlash on the teeth marked “red”.

The tooth flank backlash must apply at the narrowest point.

- ▶ If the pinion has been corrected, e.g. crowning, set the tooth flank clearance at the narrowest point.
- ▶ Then rotate the slewing bearing by 360°.



BA_GWL_006

Fig. 11: Checking the tooth flank backlash

1 Tooth flank backlash

2 Center of the tooth mesh

3 Slewing bearing

4 Driving pinion

5 Feeler gauge

- ▶ Check the tooth flank backlash at the point of the greatest eccentricity.
- ▶ Position the driving pinion **4** and slewing bearing **3** according to the figure “Checking the tooth flank backlash” ([→ fig. 11, p. 40](#)).
- ▶ Check the tooth flank backlash **1** in the center of the tooth mesh **2** with the feeler gauge **5**.
- ▶ Increase the thickness of the feeler gauge **5** until the feeler gauge **5** just fits into the gap.

4.7 Preparing for commissioning

4.7.1 Greasing the gear teeth

The gear teeth of the slewing bearing are not greased in the delivery condition.

The gear teeth must be carefully lubricated with high-quality lubricating grease suitable for the respective application before commissioning. Suitable lubricating greases are listed in the appendix. ([→ 7.3.1 Lubricating greases, p. 69](#))

- ▶ Coat or spray the gear teeth with sufficient lubricating grease.
- ▶ Remove excess lubricating grease with a suitable tool or device.
 - ▷ Contact surfaces on the tooth flanks of the gear teeth have a thin, uniform film of lubricant everywhere.

4.7.2 Greasing the bearing raceways

In the delivery condition, the bearing raceways of the slewing bearing are filled with high-quality lubricating grease suitable for the respective application by default. The lubricating grease used can be found in the installation drawing.

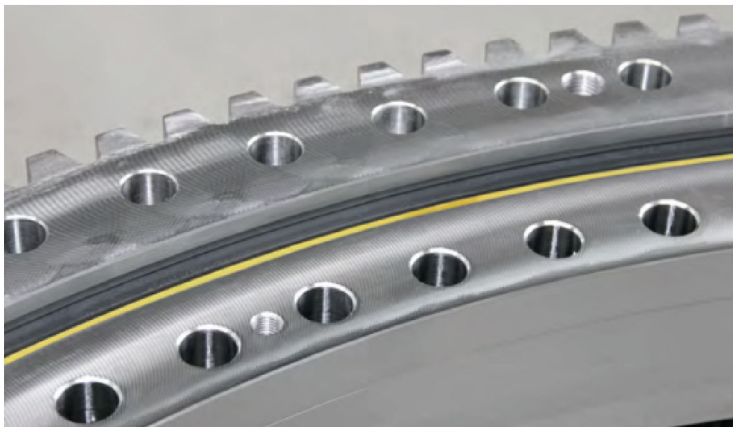


Fig. 12: Closed grease collar on bearing seal

- ▶ Before commissioning, regrease the slewing bearing at all lubricating points with fresh lubricating grease while turning it slowly until fresh lubricating grease escapes.

If the slewing bearing was stored for a longer period or an alternative lubricating grease is used:

- ▶ Lubricate the bearing raceways with lubricating grease. Suitable lubricating greases are listed in the appendix. ([→ 7.3.1 Lubricating greases, p. 69](#))
- ▶ Fill the slewing bearing at all lubricating points with fresh lubricating grease while turning it slowly until the lubricating grease is completely replaced.
 - ▷ Fresh lubricating grease escapes at the lip-type seals, evenly distributed around the periphery.
 - ▷ Fresh lubricating grease forms a closed grease collar.

4.7.3 Releasing the lip-type seal

After a longer storage period, the lip-type seals may adhere, which increases the frictional torque.

BA_GWL_008

To reduce the frictional torque to the normal value:

- ▶ Carefully lift the lip-type seal slightly with a blunt object along the entire periphery.
- ▶ Turn the slewing bearing several times 45° to the left and right.
- ▶ If necessary, wet the lip-type seal with the lubricating grease used in the bearing.
(→ [7.3.1 Lubricating greases, p. 69](#))

4.7.4 Measuring reference values for tilting clearance measurement or lowering measurement

- ▶ Permanently mark the first measuring point on the periphery of a bearing ring.
- ▶ Mark the three additional measuring points on the periphery of the bearing ring. Shift each of the markings 90°.
- ▶ During commissioning, measure the reference values for the tilting clearance measurement ([→ 5.3.7 Performing the tilting clearance measurement, p. 52](#)) or lowering measurement ([→ 5.3.8 Performing the lowering measurement, p. 54](#)).

Installation

Preparing for commissioning

5 Maintenance

5.1 Preparing for maintenance

Make sure that the following prerequisites have been met:

- ❑ The slewing bearing is only maintained by professional personnel in accordance with applicable safety regulations and rules.
- ❑ Danger from moving and rotating parts is excluded.

5.2 Maintenance plan

Abbreviations:

h = operating hours

NOTICE

Negative ambient conditions, such as vibrations, temperature fluctuations, wetness and dusty air!

Damage to the product.

- ▶ Shorten the maintenance intervals after consultation with Liebherr-Components Biberach GmbH.



Note

Regreasing intervals are not included in the maintenance schedule.

Regreasing intervals are to be established by the maintenance personnel according to the application. ([→ 5.3.1 Determining the regreasing quantity and regreasing intervals, p. 48](#))

Customer:..... Machine type:..... Serial no.:..... Operating hours:..... Date:.....

intervals (the earlier date is decisive)		Tasks to be performed			
		By maintenance personnel	By authorized specialist personnel	Confirm tasks	See page
		☐ Once-only activity ☐ Repeat interval ☐ As required ☐ Annually before the winter	☐ Once-only activity ☐ Repeat interval ☐ As required		
Bearing raceways					
	☐ Annually	☐ Take a grease sample. Shorten interval if necessary.			49
	☐ Annually	Checking the wear of the bearing raceways			52
Gear teeth					
	☐ Annually	Checking the wear of the gear teeth			56
Seals					
	☐ Every six months	Checking the seals			58
Bolted joint					
☐ 500 h	☐ Annually	Checking the fastening bolts			59

5.3 Bearing raceways



WARNING

Improper handling of hazardous substances!
Death, bodily injuries.

- ▶ Observe the manufacturer's instructions for the hazardous substances used.
- ▶ Use personal protective equipment (→ [Protective equipment, p. 11](#)).

NOTICE

Improper handling of hazardous substances!
Environmental damage.

- ▶ Observe legal regulations for disposal.

5.3.1 Determining the regreasing quantity and regreasing intervals

The goal of regreasing is to replace the lubricating grease, which has aged due to the operation of the slewing bearing and which has mixed with water, with new lubricating grease.

The regreasing quantity recommended by Liebherr-Components Biberach GmbH can be found in the installation drawing.

The regreasing quantity and regreasing intervals depend on the following factors:

- Operating conditions
 - Environmental influences
 - Bearing type
 - Type of seal
- ▶ Have the lubrication condition of the raceways checked by maintenance personnel.
 - ▶ Have maintenance personnel establish the individual regreasing quantities and regreasing intervals depending on the lubrication condition.
 - ▶ Have maintenance personnel check the grease collar.
 - ▶ Remove grease collar from old grease regularly.

5.3.2 Regreasing the bearing raceways

- ▶ Remove grease collar from old grease.

If bearing raceways are greaseproof on both sides:

- ▶ Open the relief holes.



Fig. 13: Closed grease collar on bearing seal

- ▶ Fill the slewing bearing uniformly with fresh lubricating grease at all lubricating points until fresh lubricating grease emerges from under the lip-type seals and forms a closed grease collar.
- ▶ Turn the slewing bearing 90° four times in order to evenly distribute the lubricating grease.
- ▶ Check the grease collar on the seal.
 - ▷ The grease collar has a maximum thickness of 1 cm (0.39 in) everywhere.

5.3.3 Unscheduled regreasing

Unscheduled regreasing of the slewing bearing must take place in the following circumstances:

- Before longer breaks in operation or downtimes of more than 2 months
- After longer breaks in operation or downtimes of more than 2 months
- If there is a particularly high amount of moisture, for example due to splash water or gushing water
- ▶ Regrease the bearing raceways. ([→ 5.3.2 Regreasing the bearing raceways, p. 48](#))

5.3.4 Automatic regreasing

If the bearing raceway is automatically regreased with a central lubricating device:

- ▶ Have maintenance personnel check the function.
- ▶ Have maintenance personnel check the dosing quantity.

5.3.5 Taking a grease sample

By analyzing grease samples, wear and bearing damage can be detected early and a quality analysis of the lubricating grease is possible.

Liebherr-Components Biberach GmbH recommends taking grease samples annually. Shorten interval if necessary.

For slewing bearings with a grease extraction hole, Liebherr-Components Biberach GmbH recommends taking the grease sample with a syringe. For slewing bearings without a grease extraction hole, the grease sample can be taken with a spatula.

Liebherr-Components Biberach GmbH recommends the Liebherr grease analysis kit (article code 12693519) for taking the grease samples.



Note

Liebherr-Components Biberach GmbH recommends the Liebherr grease analysis kit (article code 12693519) for taking the grease samples.

- ▶ All-inclusive grease-analysis-kit: complete measurement accessories, instructions, return envelope and return label
- ▶ Fast evaluation within 2 – 4 days
- ▶ Liebherr limit values for a higher quality statement about the grease condition of the slewing bearings.
- ▶ Execution of various tests, such as particle test, oil bleeding test, test for non-ferrous metals, test for organic substances
- ▶ **Simply scan the QR code and order the grease analysis kit!**



5.3.5.1 Taking a grease sample with a syringe

Take grease samples from the bearing raceways in the main load area. For best results, take samples at multiple locations. Mix the samples in the sample container.

Optionally, up to four grease samples can be taken distributed around the periphery. Label all grease samples.

Make sure that the following tools are available:

- ☐ Hose with a diameter of 8 (0.31)x 1 mm (0.04 in), 10 (0.39)x 1 mm (0.04 in) or 14 (0.55)x 2 mm (0.08 in)
- ☐ Syringe
- ☐ Lint-free cleaning cloth
- ☐ Sealable sample container

**Note**

The syringe can be used repeatedly as long as it is not contaminated by lubricating grease or dirt.

- ▶ Cut the hose at a 45° angle.
- ▶ Put the hose on the syringe cone.

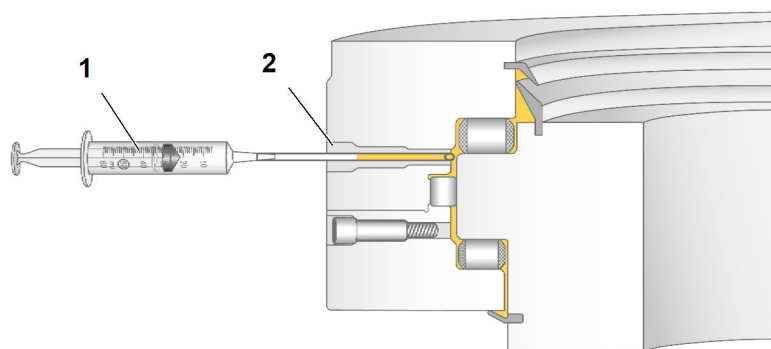


Fig. 14: Grease extraction

1 Syringe

2 Grease extraction hole

- ▶ Remove the sealing plug and screw plugs from the grease extraction hole.
- ▶ Remove the lubricating grease deposited in the extraction hole with a permissible tool.
- ▶ Clean the area around the extraction point with a lint-free cleaning cloth.
- ▶ Insert the hose with the 45° cut surface into the grease extraction hole.
- ▶ Position the 45° cut surface against the direction of rotation.



Fig. 15: Recommended filling quantity

1 Hose $\varnothing$ 8 (0.31)x 1 mm (0.04 in)

2 Hose $\varnothing$ 10 (0.39)x 1 mm (0.04 in)

3 Hose $\varnothing$ 14 (0.55)x 2 mm (0.08 in)

- ▶ Draw up the syringe until grease has reached recommended filling quantity. Make sure that the grease sample does **not** contain too much air.
- ▶ Remove the hose.
- ▶ Bend the hose in the middle.
- ▶ Put the hose with the bend upwards into a sealable container.

5.3.5.2 Taking a grease sample with a spatula



Note

Only take a grease sample with a spatula if sampling with a syringe is not possible.

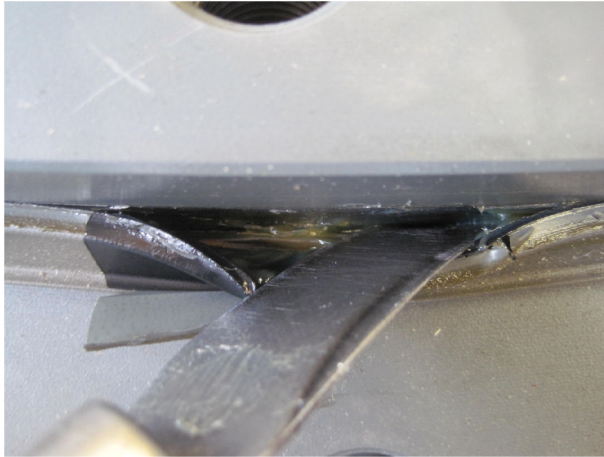
Make sure that the following tools are available:

- ☐ Spatula
- ☐ Lint-free cleaning cloth
- ☐ Sealable sample container

NOTICE

Improper cleaning!
Damage to the product.

- ▶ Clean only with a rounded cleaning tool.
-
- ▶ Remove highly contaminated grease on the outside of the lip-type seal.
 - ▶ Clean the area around the extraction point with a lint-free cleaning cloth.
 - ▶ Lift the lip-type seal with the spatula.



BA_GWL_019

Fig. 16: Grease extraction with spatula

Mix grease for an ideal reference sample.

- ▶ Remove grease with a spatula while rotating the slewing bearing slowly.
- ▶ By visual inspection, ensure that only grease that is to be analyzed is removed.
- ▶ Wipe grease on the spatula off on the bottle neck of the sample container or on the lid.

5.3.6 Checking the wear of the bearing raceways

The wear of the bearing raceways can be checked with a tilting clearance measurement or lowering measurement.

For slewing bearings mainly loaded with tilting moments, for example cranes, Liebherr-Components Biberach GmbH recommends a tilting clearance measurement. (→ [5.3.7 Performing the tilting clearance measurement, p. 52](#))

With primarily axial bearing loads, Liebherr-Components Biberach GmbH recommends the lowering measurement. (→ [5.3.8 Performing the lowering measurement, p. 54](#))

Also carry out a lowering measurement if a measurement of the tilting clearance is not possible.

5.3.7 Performing the tilting clearance measurement

Make sure that the following prerequisites have been met:

- ❑ Measuring points are established. (→ [4.7.4 Measuring reference values for tilting clearance measurement or lowering measurement, p. 43](#))
- ❑ The same conditions as during the measurement of the reference values are present.

Measure the tilting clearance between the lower connection construction and the bearing ring bolted to the upper connection construction.

To minimize the influence of elastic deformation of the connection construction, measure the tilting clearance close to the raceway system.

- Provide a dial gauge with an accuracy of 0.01 mm.

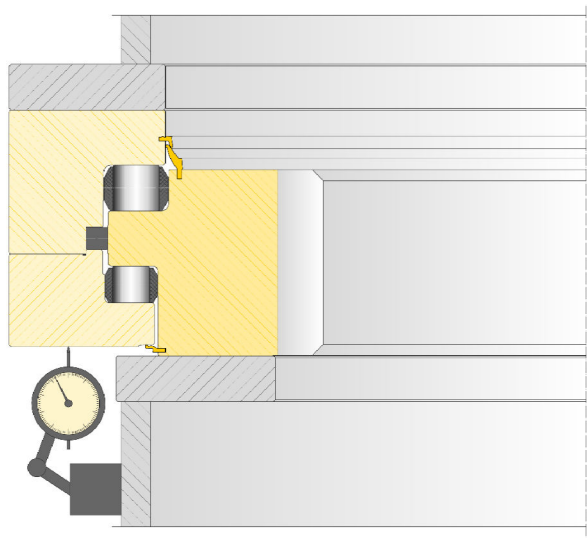


Fig. 17: Positioning the dial gauge

- Fasten the dial gauge carrying device near the bearing raceway.
- If fastening the dial gauge to the bearing rings is not possible:
- Position the dial gauge on the connection construction near the bearing rings.
 - Place the measuring tip of the dial gauge at the first measuring point.

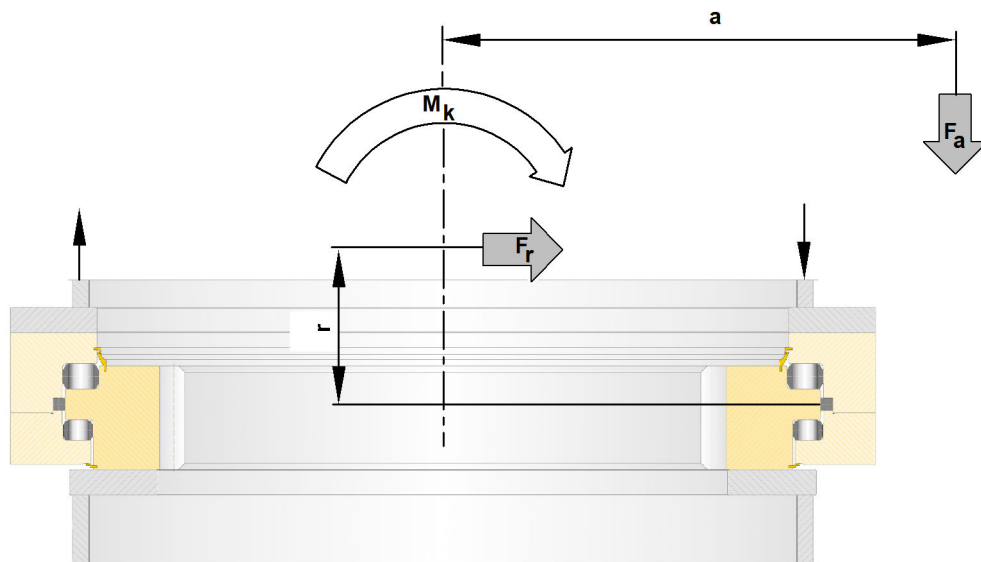


Fig. 18: Load principle of the tilting clearance measurement

- Initiate maximum reverse torque.
- Set the dial gauge to zero.
- Initiate forward tilting torque.
- Read the maximum tilting clearance on the dial gauge.
- Document the maximum tilting clearance.

- ▶ Swivel the connection construction.
- ▶ Repeat the measurement at the remaining three marked measuring points.

If the measurement is being performed for the first time:

- ▶ Document the measured values as reference values.

Proceed as follows for all additional measurements:

- ▶ Subtract the reference value from the measured value.
- ▶ Compare the differential value with the maximum permissible bearing play increase.
(→ 7.2 Maximum permissible increase of the bearing play, p. 65)

If the permissible bearing play increase is exceeded:

- ▶ Replace the slewing bearing.

5.3.8 Performing the lowering measurement

Make sure that the following prerequisites have been met:

- ❑ Measuring points are established. (→ 4.7.4 Measuring reference values for tilting clearance measurement or lowering measurement, p. 43)
- ❑ The same conditions as during the measurement of the reference values are present.

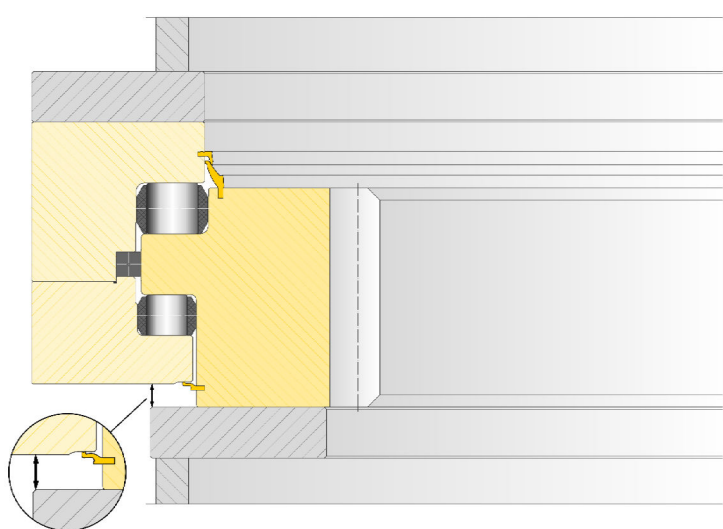
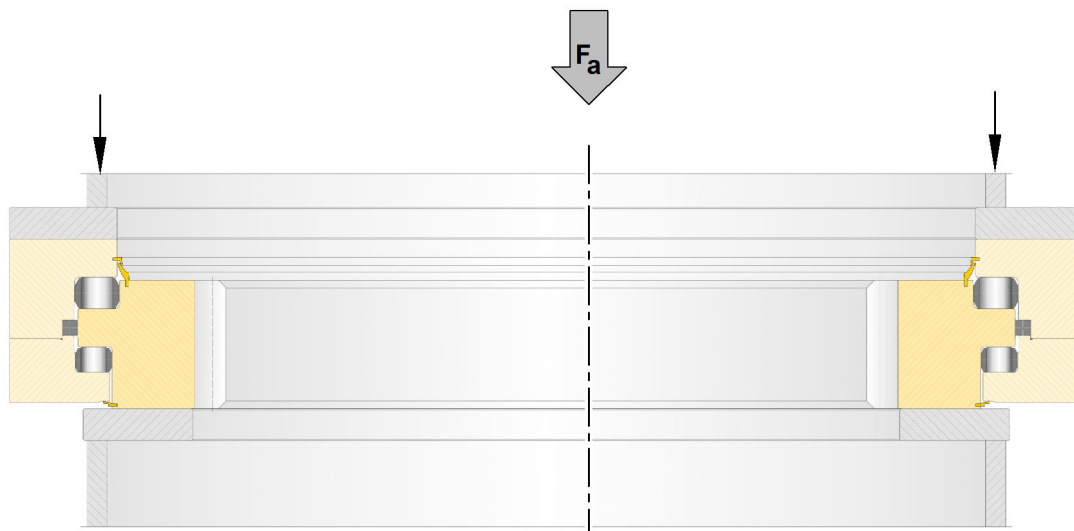


Fig. 19: Design of the lowering measurement

- ▶ Measure the lowering measurement between the lower connection construction and the bearing ring bolted to the upper connection construction.

BA_GWL_026

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BA_GWL_031

Fig. 20: Load principle of the lowering measurement

F_a = axial force

- ▶ Initiate axial force at the first measuring point according to the “Load principle of the lowering measurement” (→ fig. 20, p. 55) diagram.
- ▶ Document the recorded measured values.
- ▶ Swivel the connection construction.
- ▶ Repeat the measurement at the remaining three marked measuring points.

If the measurement is being performed for the first time:

- ▶ Document the measured values as reference values.

Proceed as follows for all additional measurements:

- ▶ Subtract the reference value from the measured value.
- ▶ Compare the differential value with the maximum permissible bearing play increase.
(→ 7.2 Maximum permissible increase of the bearing play, p. 65)

If the permissible bearing play increase is exceeded:

- ▶ Replace the slewing bearing.

5.4 Gear teeth

5.4.1 Regreasing the gear teeth



WARNING

Improper handling of hazardous substances!
Death, bodily injuries.

- ▶ Observe the manufacturer's instructions for the hazardous substances used.
 - ▶ Use personal protective equipment (→ [Protective equipment, p. 11](#)).
-

NOTICE

Improper handling of hazardous substances!
Environmental damage.

- ▶ Observe legal regulations for disposal.
-
- ▶ Make sure that the contact surfaces of the tooth flanks of the gear teeth always have a sufficient film of lubricant.
 - ▶ Coat or spray the tooth flanks with a thin and even layer of lubricating grease.
 - ▶ Remove excess lubricating grease with a suitable tool or device again.
 - ▶ Check the consistency of the lubricating film.
- If the gear teeth are automatically regreased with a central lubricating device:
- ▶ Check the function.
 - ▶ Check the dosing quantity.

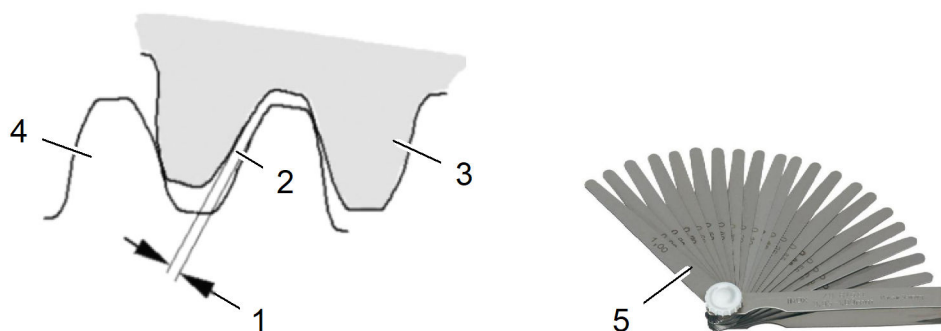
5.4.2 Checking the wear of the gear teeth

The gear teeth can wear during operation. Permissible limit values for the wear depend on the application.

The wear limit can be up to **0.1 x module**.

The maximum permissible tooth flank clearance is made up of the tooth flank clearance in new condition (**0.03 x module** to **0.06 x module**) and the wear limit (**0.1 x module**).

- ▶ Check the tooth flank backlash at the point of the greatest eccentricity.
- ▶ If the pinion has been corrected, e.g. crowning, check the tooth flank clearance at the narrowest point.



BA_GWL_006

Fig. 21: Checking the tooth flank backlash

- | | | | |
|----------|--------------------------|----------|----------------|
| 1 | Tooth flank backlash | 4 | Driving pinion |
| 2 | Center of the tooth mesh | 5 | Feeler gauge |
| 3 | Slewing bearing | | |

- ▶ Position the driving pinion **4** and slewing bearing **3** according to the figure.
- ▶ Check the tooth flank backlash **1** in the center of the tooth mesh **2** with the feeler gauge **5**.
- ▶ Increase the thickness of the feeler gauge **5** until the feeler gauge **5** just fits into the gap.

If the maximum permissible tooth flank clearance is exceeded:

- ▶ Replace the slewing bearing.

5.5 Seals

5.5.1 Checking the seals

- ▶ Check the seals for damage every 6 months.
- ▶ Replace damaged seals.

5.6 Bolted joint

5.6.1 Checking the fastening bolts



DANGER

Improper tightening of screws!
The bolted joint loosens.
Death, bodily injury.

- ▶ Use a calibrated tool.
 - ▶ Tighten screws crosswise with the permissible tightening torque or preload force.
 - ▶ Make sure that the component is pressed evenly against the connection construction.
 - ▶ Check the bolted joint at regular intervals.
-
- ▶ Make sure that the required preload force of the screws is maintained over the entire service life of the product.
 - ▶ Check the fastening bolts for signs of settling.
- If the required preload does not exist:
- ▶ Tighten the fastening bolts to the required preload using a suitable method.

6 Decommissioning

6.1 Disposal



WARNING

Improper handling of hazardous substances!
Death, bodily injuries.

- ▶ Observe the manufacturer's instructions for the hazardous substances used.
 - ▶ Use personal protective equipment (→ [Protective equipment, p. 11](#)).
-

NOTICE

Improper handling of hazardous substances!
Environmental damage.

- ▶ Observe legal regulations for disposal.
-



Note

Environmentally friendly recycling and reuse of components through professional disposal.
If there is any ambiguity regarding the materials used, Liebherr-Components Biberach GmbH will be glad to provide information (→ [Contact, p. 12](#)).

- ▶ Have the packaging disposed of by a qualified specialized company.
- ▶ Clean components of operating materials and lubricants.
- ▶ Have components disposed of by a qualified specialized company.
- ▶ Collect operating materials and lubricants in permissible receptacles.
- ▶ Have operating materials and lubricants disposed of by a qualified specialized company.

7 Appendix

7.1 Tightening torques

7.1.1 Shaft bolts

Assembly preload forces and tightening torques for shaft bolts according to VDI 2230 sheet 1						
Thread	Preload force [kN] for $\mu_e = 0.14$			Tightening torque [Nm] for $\mu_k = \mu_e = 0.14$		
	Strength rating			Strength rating		
	8.8	10.9	12.9	8.8	10.9	12.9
M10	29	42	49	54	79	93
M12	42	62	72	93	137	160
M14	58	84	99	148	218	255
M16	79	116	135	230	338	395
M18	99	141	165	329	469	549
M20	127	181	212	464	661	773
M22	158	225	264	634	904	1057
M24	183	260	305	798	1136	1329
M27	240	342	400	1176	1674	1959
M30	292	416	487	1597	2274	2662
M33	363	517	605	2161	3076	3601
M36	427	608	711	2778	3957	4631
M39	512	729	853	3597	5123	5994
M42	587	836	979	4445 ^{A)}	6331 ^{A)}	7409 ^{A)}
M45	686	978	1144	5551 ^{A)}	7906 ^{A)}	9251 ^{A)}
M48	773	1101	1288	6715 ^{A)}	9565 ^{A)}	11193 ^{A)}
M52	926	1319	1543	8628 ^{A)}	12289 ^{A)}	14381 ^{A)}
M56	1068	1522	1781	10750 ^{A)}	15311 ^{A)}	17918 ^{A)}
M60	1247	1776	2078	13334 ^{A)}	18991 ^{A)}	22224 ^{A)}
M64	1411	2010	2352	16058 ^{A)}	22871 ^{A)}	26764 ^{A)}

Tab. 9: Assembly preload forces and tightening torques for shaft bolts according to VDI 2230 sheet 1

- A) For screw sizes as of M42, the values must be verified through a strain measurement of the screw.

Values in the table “Assembly preload forces and tightening torques for shaft bolts according to VDI 2230 sheet 1” (→ [tab. 9, p. 63](#)) relate to the following conditions:

- Assembly preload forces F_M and tightening torques M_A at a utilization factor of $v = 0.9$ for shaft bolts with standard metric thread according to DIN ISO 724, DIN 13-19.
- Head dimensions of hexagon bolts according to DIN EN ISO 4014 to DIN EN ISO 4018.
- Screws with hexalobular heads according to DIN 34800 or cylinder screws according to DIN EN ISO 4762 and “medium” hole according to DIN EN 20273.
- Friction coefficients $\mu_k = \mu_g = 0.14$ at the thread and bearing surfaces.

7.1.2 Screw plugs

Overview of tightening torques of screw plugs according to LN 524-1		
Thread	Width across flats	Tightening torque
M10 x 1	5	10 Nm (7 ft-lb)
M12 x 1.5	6	20 Nm (15 ft-lb)
M14 x 1.5	6	40 Nm (30 ft-lb)
M16 x 1.5	8	40 Nm (30 ft-lb)
M18 x 1.5	8	40 Nm (30 ft-lb)
M20 x 1.5	10	50 Nm (37 ft-lb)
M22 x 1.5	10	80 Nm (59 ft-lb)
M26 x 1.5	12	80 Nm (59 ft-lb)
M27 x 2	12	90 Nm (66 ft-lb)
M33 x 2	17	120 Nm (89 ft-lb)
M42 x 2	22	200 Nm (148 ft-lb)
M48 x 2	24	300 Nm (221 ft-lb)

Tab. 10: Tightening torques for screw plugs

7.2 Maximum permissible increase of the bearing play

Raceway diameter in mm (in)	Ball diameter in mm (in)										
to	20 (0.79)	22 (0.87)	25 (0.98)	30 (1.18)	35 (1.38)	40 (1.57)	45 (1.77)	50 (1.97)	55 (2.17)	60 (2.36)	70 (2.76)
1000 (3.28)	1.5 (0.06)	1.5 (0.06)	1.5 (0.06)	1.6 (0.06)	1.8 (0.07)	2.0 (0.08)	2.2 (0.09)	2.6 (0.1)	2.6 (0.1)		
1250 (4.1)	1.5 (0.06)	1.6 (0.06)	1.6 (0.06)	1.7 (0.07)	1.8 (0.07)	2.1 (0.08)	2.3 (0.09)	2.7 (0.11)	2.7 (0.11)	2.8 (0.11)	
1500 (4.92)	1.6 (0.06)	1.7	1.7 (0.07)	1.8 (0.07)	1.8 (0.07)	2.1 (0.08)	2.4 (0.09)	2.7 (0.11)	2.8 (0.11)	2.9 (0.11)	3.0 (0.12)
1750 (5.74)			1.8 (0.07)	1.8 (0.07)	1.9 (0.07)	2.2 (0.09)	2.4 (0.09)	2.8 (0.11)	2.9 (0.11)	3.0 (0.12)	3.1 (0.12)
2000 (6.56)			1.8 (0.07)	1.9 (0.07)	2.0 (0.08)	2.3 (0.09)	2.5 (0.1)	2.9 (0.11)	2.9 (0.11)	3.0 (0.12)	3.2 (0.13)
2250 (7.38)			1.9 (0.07)	2.0 (0.08)	2.1 (0.08)	2.4 (0.09)	2.6 (0.1)	3.0 (0.12)	3.0 (0.12)	3.1 (0.12)	3.3 (0.13)
2500 (8.2)			1.9 (0.07)	2.0 (0.08)	2.1 (0.08)	2.4 (0.09)	2.7 (0.11)	3.0 (0.12)	3.1 (0.12)	3.2 (0.13)	3.3 (0.13)
2750 (9.02)			2.0 (0.08)	2.1 (0.08)	2.2 (0.09)	2.5 (0.1)	2.7 (0.11)	3.1 (0.12)	3.2 (0.13)	3.3 (0.13)	3.4 (0.13)
3000 (9.84)					2.3 (0.09)	2.6 (0.1)	2.7 (0.11)	3.2 (0.13)		3.3 (0.13)	3.5 (0.14)
3250 (10.66)					2.4 (0.09)	2.7 (0.11)	2.9 (0.11)	3.3 (0.13)		3.4 (0.13)	3.6 (0.14)
3500 (11.48)						2.8 (0.11)	3.0 (0.12)	3.3 (0.13)		3.5 (0.14)	3.6 (0.14)
3750 (12.3)						2.9 (0.11)	3.1 (0.12)	3.4 (0.13)		3.6 (0.14)	3.7 (0.15)
4000 (13.12)						3.0 (0.12)		3.4 (0.13)		3.7 (0.15)	3.8 (0.15)
4500 (14.76)								3.6 (0.14)		3.9 (0.15)	4.0 (0.16)
5000 (16.4)								3.8 (0.15)		4.1 (0.16)	4.2 (0.17)
5500 (18.04)								4.0 (0.16)		4.3 (0.17)	4.4 (0.17)
6000 (19.69)								4.2 (0.17)		4.6 (0.18)	4.7 (0.19)
6500 (21.33)										4.7 (0.19)	4.8 (0.19)
7000 (22.97)										4.9 (0.19)	5.0 (0.2)
7500 (24.61)											5.1 (0.2)

Appendix

Maximum permissible increase of the bearing play

Raceway diameter in mm (in)	Ball diameter in mm (in)										
to	20 (0.79)	22 (0.87)	25 (0.98)	30 (1.18)	35 (1.38)	40 (1.57)	45 (1.77)	50 (1.97)	55 (2.17)	60 (2.36)	70 (2.76)
8000 (26.25)											5.4 (0.21)
> 8000 (26.25)	Upon request										

Tab. 11: Maximum permissible increase of the bearing play for single row and double row four point bearings

Raceway diameter in mm (in)	Ball diameter in mm (in)										
to	18 (0.71)	20 (0.79)	22 (0.87)	25 (0.98)	30 (1.18)	35 (1.38)	40 (1.57)	45 (1.77)	50 (1.97)	60 (2.36)	70 (2.76)
1000 (3.28)	1.9 (0.07)	1.9 (0.07)	2.0 (0.08)	2.0 (0.08)	2.1 (0.08)	2.2 (0.09)	2.6 (0.1)	2.9 (0.11)			
1250 (4.1)	2.0 (0.08)	2.0 (0.08)	2.1 (0.08)	2.1 (0.08)	2.2 (0.09)	2.3 (0.09)	2.7 (0.11)	3.0 (0.12)	3.5 (0.14)	3.7 (0.15)	
1500 (4.92)		2.0 (0.08)	2.2 (0.09)	2.2 (0.09)	2.3 (0.09)	2.4 (0.09)	2.7 (0.11)	3.0 (0.12)	3.5 (0.14)	3.7 (0.15)	
1750 (5.74)			2.3 (0.09)	2.3 (0.09)	2.4 (0.09)	2.5 (0.1)	2.9 (0.11)	3.1 (0.12)	3.6 (0.14)	3.8 (0.15)	4.1 (0.16)
2000 (6.56)				2.4 (0.09)	2.5 (0.1)	2.6 (0.1)	3.0 (0.12)	3.3 (0.13)	3.8 (0.15)	3.9 (0.15)	4.2 (0.17)
2250 (7.38)					2.6 (0.1)	2.7 (0.11)	3.1 (0.12)	3.4 (0.13)	3.9 (0.15)	4.0 (0.16)	4.3 (0.17)
2500 (8.2)						2.8 (0.11)	3.2 (0.13)	3.5 (0.14)	4.0 (0.16)	4.2 (0.17)	4.4 (0.17)
2750 (9.02)						2.9 (0.11)	3.3 (0.13)	3.6 (0.14)	4.1 (0.16)	4.3 (0.17)	4.5 (0.18)
3000 (9.84)							3.4 (0.13)	3.7 (0.15)	4.2 (0.17)	4.4 (0.17)	4.6 (0.18)
3250 (10.66)							3.5 (0.14)	3.8 (0.15)	4.3 (0.17)	4.5 (0.18)	4.7 (0.19)
3500 (11.48)							3.6 (0.14)	3.9 (0.15)	4.4 (0.17)	4.6 (0.18)	4.8 (0.19)
3750 (12.3)							3.6 (0.14)	3.9 (0.15)	4.5 (0.18)	4.7 (0.19)	4.9 (0.19)
4000 (13.12)								4.1 (0.16)	4.6 (0.18)	4.8 (0.19)	5.1 (0.2)
4500 (14.76)									5.0 (0.2)	5.2 (0.2)	5.5 (0.22)
5500 (18.04)									5.2 (0.2)	5.4 (0.21)	5.6 (0.22)
6000 (19.69)									5.4 (0.21)	5.6 (0.22)	5.8 (0.23)

Raceway diameter in mm (in)	Ball diameter in mm (in)										
to	18 (0.71)	20 (0.79)	22 (0.87)	25 (0.98)	30 (1.18)	35 (1.38)	40 (1.57)	45 (1.77)	50 (1.97)	60 (2.36)	70 (2.76)
6500 (21.33)										5.8 (0.23)	6.0 (0.24)
7000 (22.97)										6.0 (0.24)	6.2 (0.24)
7500 (24.61)											6.4 (0.25)
8000 (26.25)											6.6 (0.26)
> 8000 (26.25)	Upon request										

Tab. 12: Maximum permissible increase of the bearing play for double row ball slewing rings

Raceway diameter in mm (in)	Roller diameter in mm (in)										
to	16 (0.63)	21 (0.83)	24 (0.94)	26 (1.02)	32 (1.26)	36 (1.42)	40 (1.57)	50 (1.97)	60 (2.36)	70 (2.76)	80 (3.15)
400 (1.31)	0.20 (0.01)	0.22 (0.01)	0.23 (0.01)	0.24 (0.01)							
500 (1.64)	0.21 (0.01)	0.23 (0.01)	0.24 (0.01)	0.25 (0.01)	0.28 (0.01)						
630 (2.07)	0.26 (0.01)	0.28 (0.01)	0.29 (0.01)	0.30 (0.01)	0.34 (0.01)	0.37 (0.01)	0.39 (0.02)				
800 (2.62)	0.26 (0.01)	0.28 (0.01)	0.29 (0.01)	0.30 (0.01)	0.34 (0.01)	0.37 (0.01)	0.39 (0.02)				
1000 (3.28)	0.31 (0.01)	0.33 (0.01)	0.34 (0.01)	0.35 (0.01)	0.39 (0.02)	0.42 (0.02)	0.44 (0.02)				
1250 (4.1)	0.41 (0.02)	0.43 (0.02)	0.44 (0.02)	0.45 (0.02)	0.49 (0.02)	0.52 (0.02)	0.54 (0.02)	0.61 (0.02)			
1500 (4.92)	0.51 (0.02)	0.53 (0.02)	0.54 (0.02)	0.55 (0.02)	0.59 (0.02)	0.62 (0.02)	0.64 (0.03)	0.71 (0.03)			
2000 (6.56)	0.60 (0.02)	0.63 (0.02)	0.64 (0.03)	0.65 (0.03)	0.69 (0.03)	0.72 (0.03)	0.74 (0.03)	0.81 (0.03)	0.91 (0.04)		
2500 (8.2)	0.66 (0.03)	0.70 (0.03)	0.72 (0.03)	0.74 (0.03)	0.79 (0.03)	0.82 (0.03)	0.84 (0.03)	0.91 (0.04)	1.01 (0.04)	1.11 (0.04)	1.21 (0.05)
3150 (10.33)	0.76 (0.03)	0.80 (0.03)		0.84 (0.03)	0.89 (0.04)	0.92 (0.04)	0.94 (0.04)	1.01 (0.04)	1.11 (0.04)	1.21 (0.05)	1.31 (0.05)
4000 (13.12)				0.94 (0.04)	0.99 (0.04)	1.02 (0.04)	1.04 (0.04)	1.11 (0.04)	1.21 (0.05)	1.31 (0.05)	1.41 (0.06)
5000 (16.4)					1.09 (0.04)		1.13 (0.04)	1.21 (0.05)	1.31 (0.05)		
6000 (19.69)					1.19 (0.05)		1.24 (0.05)	1.31 (0.05)	1.41 (0.06)		

Raceway diameter in mm (in)	Roller diameter in mm (in)										
to	16 (0.63)	21 (0.83)	24 (0.94)	26 (1.02)	32 (1.26)	36 (1.42)	40 (1.57)	50 (1.97)	60 (2.36)	70 (2.76)	80 (3.15)
7000 (22.97)								1.41 (0.06)	1.50 (0.06)		
8000 (26.25)									1.61 (0.06)		
> 8000 (26.25)	Upon request										

Tab. 13: Maximum permissible increase of the bearing play for three row roller slewing rings

7.3 Lubricants and operating materials

7.3.1 Lubricating greases

The type of lubricating grease is specified on the technical drawing.



Note

When using centralized lubrication devices, consult with the manufacturers of the lubricating grease and the centralized lubrication device to verify that the lubricant used is compatible with the centralized lubrication device.

The lubricating grease listed is approved for the slewing bearings by Liebherr-Components Biberach GmbH. The lubricating grease has been tested by Liebherr-Components Biberach GmbH for compatibility with the anti-friction bearing installation elements.

Liebherr-Components Biberach GmbH recommends using Liebherr lubricating greases for slewing bearings.

Manufacturer	Rolling contact (KPF 2 N-25 or KPFHC 1 N-60)	Gear teeth contact (OGPF 2 S-30)
Liebherr	Universal grease 9900 248 K to 423 K -25 °C (-13 °F) to 150 °C (302 °F)	Universal grease 9900 248 K to 423 K -25 °C (-13 °F) to 150 °C (302 °F)
	Universal grease arctic 213 K to 413 K -60 °C (-76 °F) to 140 °C (284 °F)	

Tab. 14: Liebherr lubricating greases for slewing bearings

The lubricating greases in the table (→ tab. 14, p. 69) can be mixed together.

If it is not possible to obtain the Liebherr lubricating grease, lubricating greases from the following table can be used as an alternative (→ tab. 15, p. 69).

The suitability and use of lubricating greases not supplied by Liebherr-Components Biberach GmbH are based on the recommendation of the respective manufacturer.

Manufacturer	Rolling contact (KPF 2 N-25 or KPFHC 1 N-60)	Gear teeth contact (OGPF 2 S-30)
Aral	Aralub HLP2 243 K to 393 K (-30 °C (-22 °F) to 120 °C (248 °F))	Castrol Molub Alloy OG 936 SF Heavy 243 K to 373 K (-30 °C (-22 °F) to 100 °C (212 °F))
Castrol	Spheerol EPL 2 253 K to 413 K (-20 °C (-4 °F) to 140 °C (284 °F))	Castrol Molub Alloy OG 9790/2500-0 253 K to 363 K (-20 °C (-4 °F) to 90 °C (194 °F))
Klüber	Centoplex EP 2 253 K to 403 K (-20 °C (-4 °F) to 130 °C (266 °F))	Grafloscon C-SG 0 ultra 243 K to 473 K (-30 °C (-22 °F) to 200 °C (392 °F))

Manufacturer	Rolling contact (KPF 2 N-25 or KPFHC 1 N-60)	Gear teeth contact (OGPF 2 S-30)
Lubritech	Lagermeister EP-2 253 K to 403 K (-20 °C (-4 °F) to 130 °C (266 °F))	Ceplattyn KG 10 HMF 263 K to 413 K (-10 °C (14 °F) to 140 °C (284 °F))
Mobil	Mobilux EP 2 253 K to 393 K (-20 °C (-4 °F) to 120 °C (248 °F))	Mobilgear OGL 461 253 K to 393 K (-20 °C (-4 °F) to 120 °C (248 °F))
Shell	Gadus S2 V220 2 248 K to 403 K (-25 °C (-13 °F) to 130 °C (266 °F))	Gadus S2 OGH NLGI 0/00 263 K to 473 K (-10 °C (14 °F) to 200 °C (392 °F))
Total	Multis EP 2 248 K to 393 K (-25 °C (-13 °F) to 120 °C (248 °F))	Copal OGL 0 248 K to 423 K (-25 °C (-13 °F) to 150 °C (302 °F))

Tab. 15: Alternative lubricating greases for slewing bearings

If other lubricating greases are to be used to lubricate the raceway, Liebherr-Components Biberach GmbH recommends lubricating greases with the following properties:

- Sufficient application temperature range
- Sufficient lubricating ability of the base oil
- Sufficient corrosion protection properties according to DIN 51802
- Low tendency to absorb water according to DIN 51807
- Sufficient adhesive properties
- Good aging resistance

When using other lubricating greases, their suitability must be clarified with the grease manufacturer. Compatibility with the material used by Liebherr-Components Biberach GmbH must be ensured. Special lubricating greases are required for low temperature applications.

If other lubricating greases are to be used to lubricate the gear teeth, the same requirements apply as for the bearing raceways. Liebherr-Components Biberach GmbH also recommends using lubricating greases with EP (extreme pressure) additives.

7.4 Technical documents

Liebherr-Lubricants

Technical Datasheet



Application / Description

Liebherr Universalfett 9900 is a high performance lubricating grease based on VCI-technology. It is squeeze-stable, very adherent, and resistant to ageing and water. The product has been developed as a multi-purpose grease for the lubrication of Liebherr construction machines, as well as slewing ring antifriction bearings, bolts, gearwheels, axles, screws and much more. Liebherr Universalfett 9900 is based on a special lithium complex soap and equipped with a highly efficient corrosion protection system (VCI). Extreme-Pressure Additives and a select combination of solid lubricants with Teflon and other synergistic active additives offer safe protection against wear and corrosion fatigue. Suitable for central lubrication systems up to -20°C (consider pumpability and manufacturer data).

Application temperature

- 25°C to +150° C
up to - 20°C pumpable in central lubrication systems
temporarily admissible temperature peak +200°C

Qualification

DIN 51 502	KPF 2 N - 25
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Technical specifications

Chemical and physical characteristics	Test method	Liebherr Universalfett 9900
NLGI-class	DIN 51 818	2
Soap base	-	Lithium complex
Colour	-	beige
Worked penetration 0,1 mm	DIN ISO 2137	265 - 295
Behaviour with respect to water (static test)	DIN 51 807/1	0 - 90
VKA-welding load N	DIN 51 350/4	> 6000
Riffel protection test R _{tmax} / R _{tmin} / corr.	FVA 431	5 / 1,6 / 2,5

The listed ASTM testing standards are similar to, but not identical to, the DIN testing standards under which Liebherr Lubricants and Coolants have been evaluated.

Corresponding standards:
DIN ISO 2137 - ASTM D 217
DIN 51 807/1 - ASTM D 1264
DIN 51 350 / 4 - ASTM D 2596

Packing units / Identification numbers

packing size	Identification number
400g (0,88 lb) cartridge	10 29 68 16
400g (0,88 lb) Lube Shuttle® cartridge	10 66 47 21
4 x 400g (4x0,88 lb) cartridge	10 42 50 86
24 x 400g (24x0,88 lb) cartridge	10 42 68 15
24 x 400g (24x0,88 lb) Lube Shuttle® cartridge	11 10 08 90
10kg (22,04 lb) pail	10 29 68 13
25kg (55,11 lb) pail	10 29 68 12
50kg (110,23 lb) pail	10 29 68 11
180kg (396,83 lb) pail	10 29 68 10

Lube-Shuttle® is a registered trademark of MATO

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Liebherr-Lubricants Technical Datasheet

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Liebherr-Lubricants

Technical Datasheet



Liebherr Universalfett Arctic

Application / Description

Liebherr Universalfett Arctic was developed as a universal grease for the lubrication of Liebherr construction machines, rotary bearings, bolts, gearwheels, axles, screws and much more, especially at very low temperatures. It is also suitable for lubricating systems. Liebherr Universalfett Arctic is squeeze- stable, oxidation and water resistant. It shows excellent anti-corrosion and anti-wear properties. The use of high-quality synthetic oils, white solid lubricants and special EP additives guarantees that Liebherr Universalfett Arctic offers optimal lubricating reliability, even under extreme conditions, and shows low start-up resistance at low temperatures, and thereby contributes to the reduction of fuel consumption. Suitable for central lubrication units at low temperatures down to -55°C (consider pumpability and manufacturer data).

Application temperature

-60°C to +140°C
up to -55°C pumpable in central lubrication systems

Qualification

DIN 51 502 | KPFGC 1 N -60

Technical specifications

Chemical and physical characteristics		Test method	Liebherr Universalfett Arctic
NLGI-class		DIN 51 818	1
Soap base		-	Lithium complex
Colour		-	blue
Worked penetration	0,1 mm	DIN ISO 2137	310 - 340
Behaviour with respect to water	(static test)	DIN 51 807/1	1 - 90
VKA-welding load	N	DIN 51 350/4	5500

The listed ASTM testing standards are similar to, but not identical to, the DIN testing standards under which Liebherr Lubricants and Coolants have been evaluated.

Corresponding standards:
DIN ISO 2137 - ASTM D 217
DIN 51 807/1 - ASTM D 1264
DIN 51 350 / 4 - ASTM D 2596

Packing units / Identification numbers

packing size	Identification number
400g (0,88 lb) cartridge	10 29 68 28
24x400g (24x0,88 lb) cartridge	10 29 68 27
10kg (22,04 lb) pail	10 29 68 25
25kg (55,11 lb) pail	10 29 68 24
50kg (110,23 lb) pail	10 29 68 23
180kg (396,83 lb) drum	10 29 68 22

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Liebherr-Lubricants Technical Datasheet

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Liebherr-Lubricants

Technical Datasheet

Liebherr Spezialfett 9610 Plus

Description:

Liebherr Spezialfett 9610 Plus has especially been developed for loaded roller bearings and plain bearings as well as for long-term applications. This grease covers a large range of applications such as slewing ring antifriction bearings, bolts, gearwheels, axles, screws and many others. Liebherr Spezialfett 9610 Plus is squeeze-stable, adhesive and resistant to aging. The product offers excellent corrosion protection properties. Also if moisture enters the bearing, the special inhibitors are effective, especially in the rolling butt contact. The product contains special high pressure (EP) additives to reduce mechanical wear.

Application:

For use in the following Liebherr machines and other high-performance machines and vehicles according to the manufacturer's requirements:



Temperature:

-20°C to +120°C
up to -15°C pumpable in central lubrication systems
short-term peaks up to +140°C

Specifications & Qualifications:

DIN 51 502	KP 2 K - 20
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Typical physical data:

Chemical and physical characteristics	Test method	Value
NLGI-class	DIN 51 818	2
Soap base	-	lithium-12-hydroxystearate
Color	-	Light brown
Worked penetration	DIN ISO 2137	265 - 295
Drop point	°C DIN ISO 2176	ca. 194

The listed ASTM testing standards are similar to, but not identical to, the DIN testing standards under which Liebherr Lubricants and Coolants have been evaluated.
Corresponding standards:
DIN ISO 2137 - ASTM D 217

Advantages:

Covers a large range of applications such as slewing ring antifriction bearings, bolts, gearwheels, axles, screws and many others.

High water resistant.

861305108_Liebherr Spezialfett 9610 Plus_TDB_US



Packing units / Identification numbers:

packing size	Identification number
400g (0,88 lb) cartridge	8 61 30 29 08
10kg (22,04 lb) pail	8 61 30 13 08
25kg (55,11 lb) pail	8 61 30 45 08
50kg (110,23 lb) pail	8 61 30 53 08
180kg (396,83 lb) pail	8 61 30 51 08

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