

Wire Race Bearings Slim Bearings Bearing Assemblies

Mounting and Maintenance Instructions

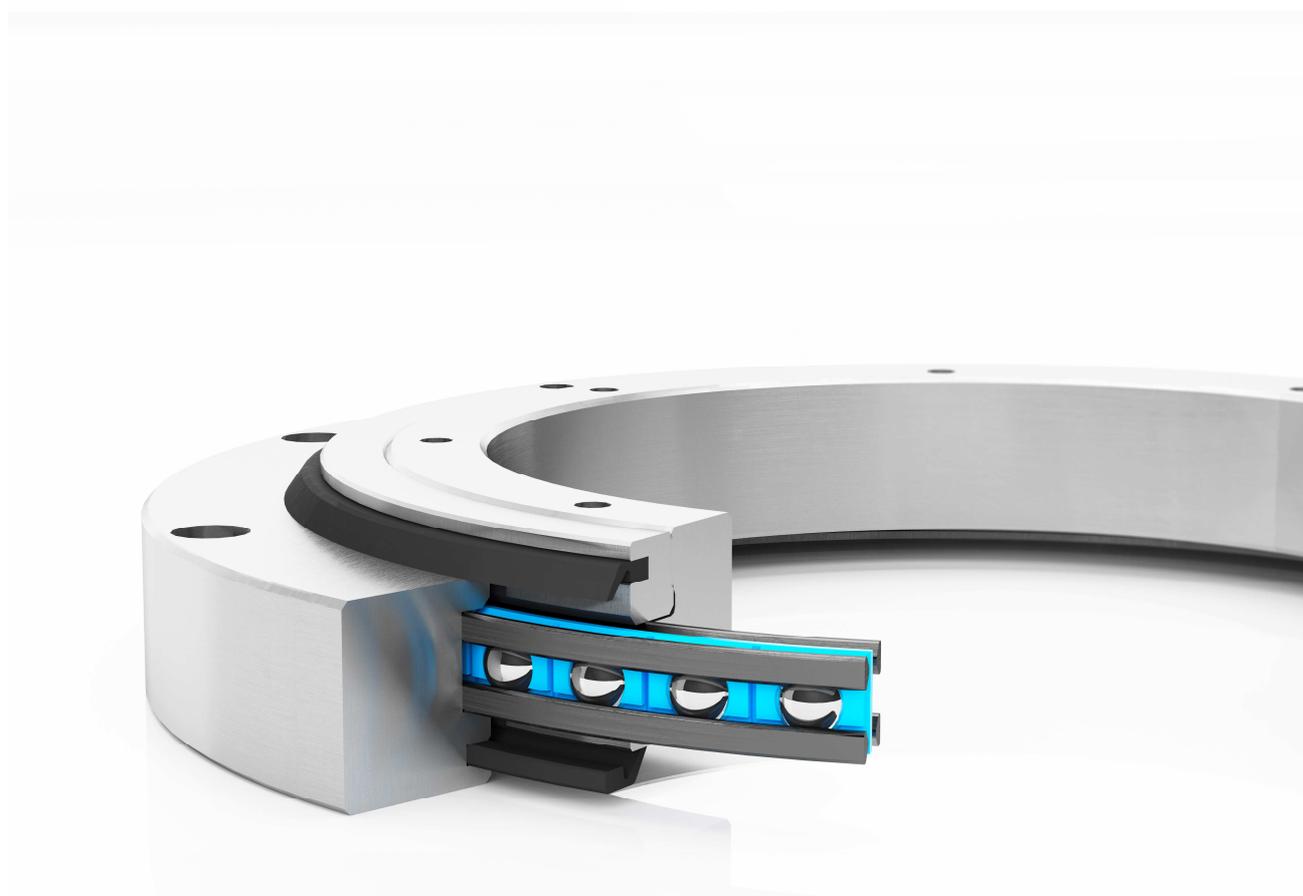


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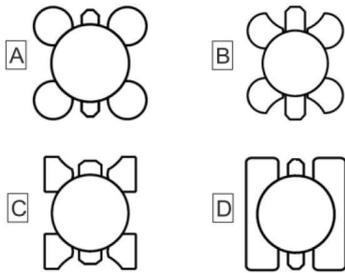
Information about these instructions	<p>These instructions enable safe and efficient handling of Franke Bearing assemblies and bearing elements. These instructions are a component of the Bearing assembly and must be kept in the immediate vicinity of the machine in which the Bearing assembly has been installed, so that they are accessible to the personnel at any time.</p> <p>Before beginning any work, the personnel must have read through these instructions carefully and understood them. The basic requirement for safe working is adherence to all the specified safety instructions and procedural instructions hereinafter.</p> <p>In addition, the local technical measures for occupational safety and health and general safety instructions for the field of application of the Bearing assembly apply.</p>
Customer service	<p>Franke GmbH, Obere Bahnstraße 64 73431 Aalen, Germany Phone: +49 7361 920-0 Fax: +49 7361 920-120 Email: info@franke-gmbh.de Internet: www.franke-gmbh.com</p>
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1 Overview

1.1 Bearing elements (wire-race-bearings) / slim bearings

Overview



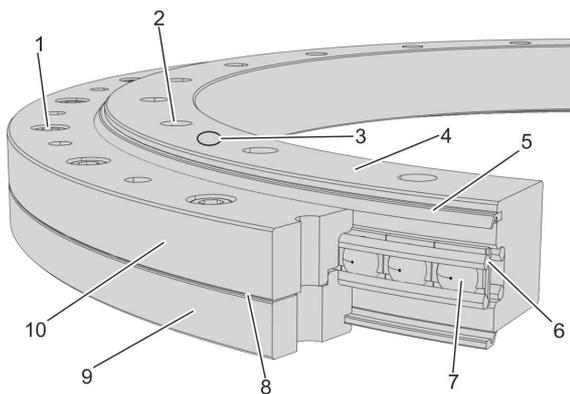
Bearing elements (Type LE...) consist of four race rings and a cage with retained balls. The cage might be segmented in several parts. The bearing elements are available in different types:

- LEL type: Round profile with ground raceways
- LED type: Double profile with profiled raceways
- LER type: Rectangular profile with profiled raceways
- LSA type: slim bearings with profiled raceways

Fig 1: LEL (A), LED (B), LER (C), LSA (D)

1.2 Bearing assemblies

Overview



- 1 Attachment screws at outer ring
- 2 Attachment screws at inner ring
- 3 Retaining screws
- 4 Inner connecting structure (inner ring)
- 5 Seal
- 6 Race rings
- 7 Cage segments with balls
- 8 Adjustment surface
- 9 Outer ring
- 10 Outer ring

Fig 2: Bearing assembly

Bearing assemblies (type LV...) are ready to mount complete bearings with integrated bearing elements. Depending on the usage of the bearing assembly it can be designed according to the requirements of the customer. Outer dimensions, material of the inner and outer ring as well as bore shape and rotational resistance can be chosen individually.

2 Installation

2.1 Installation of bearing elements / slim bearings



The installation of the bearing elements must be done at a clean workplace. Sufficient space must be provided for the bearing elements at the installation site and the deposit station must have sufficient stability.



Prior to installation clean the race rings. For this, use a clean, lint-free cloth and remove the corrosion protection and any contamination from the track.

2.1.1 Installation of bearing elements type LE...

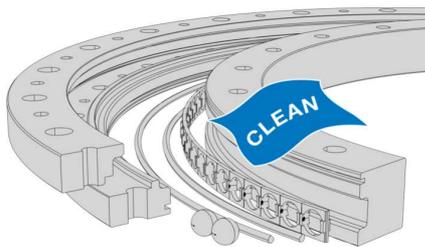


Fig. 3: Cleaning components

1. Clean components with a clean, lint-free cloth.



During installation hold the race ring in position, coat the seat of the race rings in the inner and outer connecting structure with some grease.

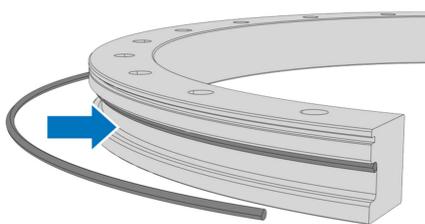


Fig. 4: Insert race rings

2. Insert the race rings in the inner and outer connecting structure. Here, watch the diameter of the race rings. Insert the race rings in a manner that the smoothed or profiled tracks are aligned to each other and the impact locations are offset by 180°.

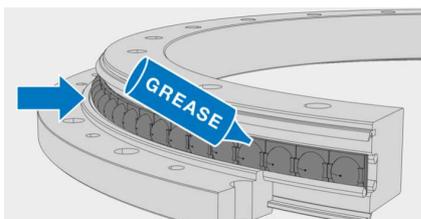


Fig. 5: Insert balls and cage

3. Lubricate the cage segments and insert in the inner connecting structure.



Use only the balls that are within the scope of delivery. Should balls be lost, then all the balls must be exchanged to ensure the race characteristics of the bearing are not impaired.

Installation

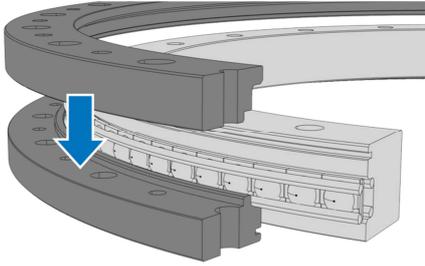


Fig. 6: Closing the bearing

4. Close the bearing on the divided side. Here, ensure that the hole-pattern of the divided outer ring match.

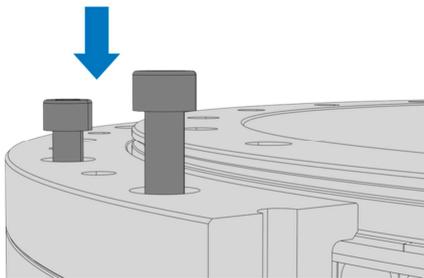


Fig. 7: Insert screws

4. Insert retaining screws in the provided boring. Only use screws with a screw property class of at least SAE J-429 Grade 5.2.
5. Adjust the bearing to the correct rotational resistance, using adjustment shims or performing a massive adjustment (☞ Chapter 0 "2.1.3 Adjusting the bearing elements" on page 9).

2.1.2 Installation of slim bearing type LSA



Fig. 8: Clean the inner ring

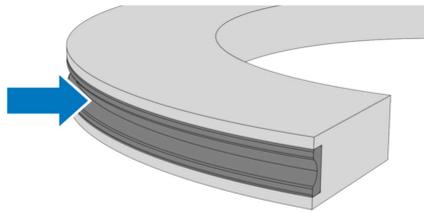
1. Clean inner ring of bearing with a clean, lint-free cloth.



Fig. 9: Lubricate wire

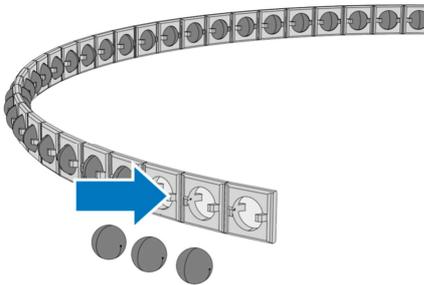
2. Lubricate race rings (wire backs).

Installation



3. Insert inner race ring in the inner ring of the bearing. Ensure that the race ring ends are not set on impact (have a gap).

Fig. 10: Insert inner race ring

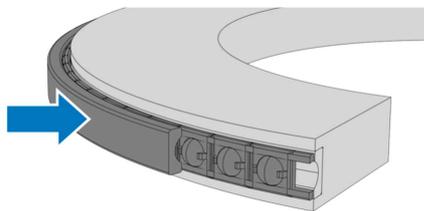


4. If required, place balls in the band cage or in the cage segment.

NOTICE!

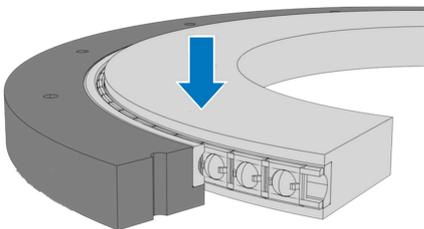
During installation of the cage segments use only the balls contained within the delivery. If balls are lost, all the balls must be exchanged to ensure the race characteristics of the bearing are not impaired. Always use care when moving the cage or cage segments.

Fig. 11: Insert balls



5. Place the cage and the outer race ring according to Fig. 19 onto the inner race ring. When doing so, hold the race ring ends of the outer race ring together to avoid that the ball packages slips out.

Fig. 12: Place cage and outer ring



6. Place outer ring and insert axial.

Fig. 13 Place outer ring

Installation

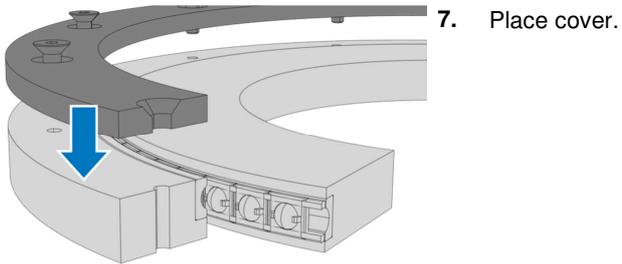


Fig. 21: Place cover

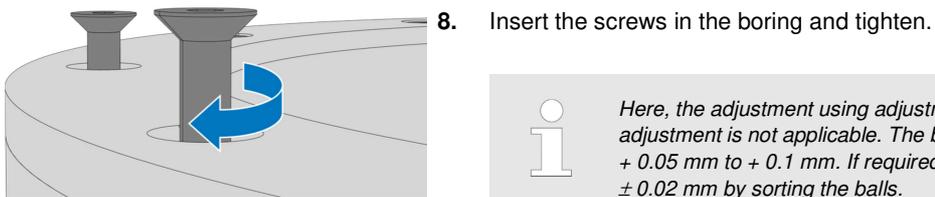


Fig. 22: Tighten screws



Here, the adjustment using adjustment shims or a massive adjustment is not applicable. The bearing has a play of + 0.05 mm to + 0.1 mm. If required, the play can be reduced by ± 0.02 mm by sorting the balls.

Tolerances for the installation height

Divided ring	- 0.05 mm
One-piece ring	+ 0.05 mm

Installation tolerances for the diameter

KK \emptyset	[mm]	to 150	150-300	starting at $\emptyset 300$
T (outer ring)	[mm]	+ 0.03	+ 0.04	+ 0.05
T (inner ring)	[mm]	- 0.03	- 0.04	- 0.05

2.1.3 Adjusting the bearing elements / slim bearings

2.1.3.1 Adjusting the bearing elements using adjustment shims

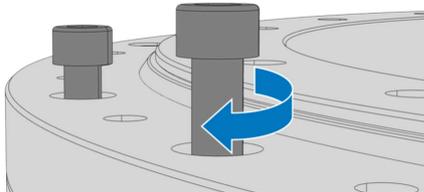


Fig. 1: Tightening the retaining screws

1. Insert the retaining screws and tighten slightly by hand cross-wards (Fig. 48). Only use screws according to the design engineers specification, having a screw property class of at least 8.8.

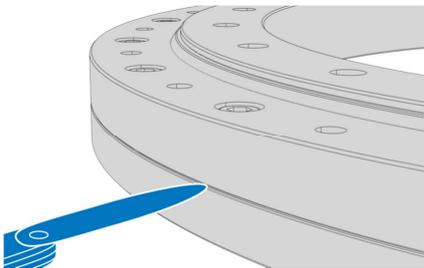


Fig. 24: Measure the gap between the connecting structure using a feeler gage

2. Measure the gap, between the divided connecting structure, at different locations around the circumference, with a feeler gage.
3. Add the measured values and calculate the mean value.
4. Select adjustment shims according to the table.



The strength of the adjustment shim may not undercut the calculated value by more than 0.01 mm.

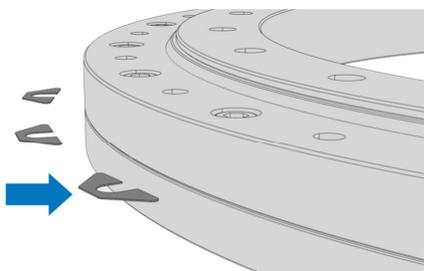


Fig. 25: Inserting the adjustment shims

5. Distribute the adjustment shims (Fig. 25) between all retaining and attachment screws of the connecting structure. Here, ensure that the adjustment shims are attached in a manner that allows problem-free insertion of the attachment screws.



The adjustment shims are available from the manufacturer, depending on screw diameter, in different strength.

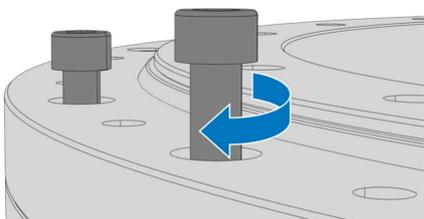


Fig. 26: Tightening the attachment screws

6. Tighten the attachment screws according to the stipulated tightening torque.

Order number of adjustment shims

Installation

Thickness [mm]	0.025	0.10	0.15	0.20	0.25	0.30	0.50	1.00
M6	79015A	79034A	79035A	79036A	79037A	79038A	79039A	79040A
M8	79041A	79023A	79042A	79000A	79026A	79043A	79044A	79045A
M10	79046A	79012A	79010A	79011A	79047A	79048A	79049A	79050A
M12	79118A	79051A	79052A	79053A	79054A	79055A	79056A	79065A
M16	79119A	79024A	79066A	79057A	79058A	79059A	79060A	79061A

2.1.3.2 Adjusting the bearing elements via massive adjustment

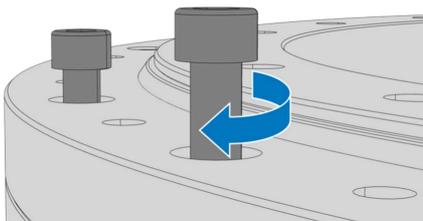


Fig. 20: Tightening the retaining screws

1. Insert retaining screws and tighten cross-wise.



Heed the tightening torque of the screws!

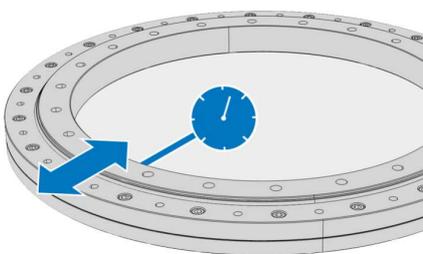


Fig. 21: Check radial play

2. Rotate bearing 2–3 times by 360°. Thereafter check the radial play between the outer and inner ring using a dial gage.



The dial gage is attached to the outer ring. The radial play is measured via the force application using the inside diameter of the inner ring. To form the mean value, the radial play is measured at four positions that are offset by 90°.

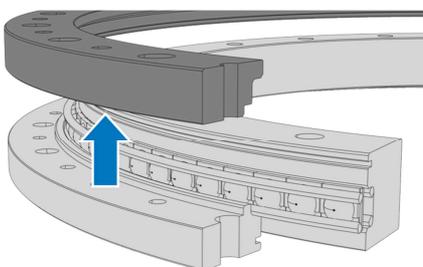


Fig. 22: Removing the adjustment ring

3. Remove adjustment ring (Fig. 29).

Installation

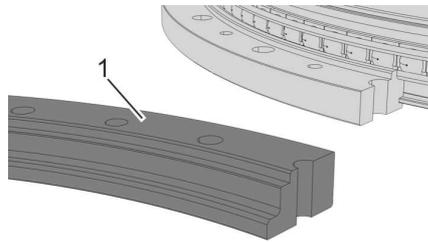


Fig. 23: Grinding the adjustment ring

4. Grind off the determined value plus the additional value of 0.02–0.03 mm using a flat round grinding machine from the adjustment ring at the adjustment surface.
5. Remove abrasive dust.

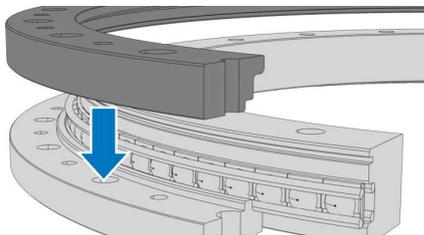


Fig. 24: Install the adjustment rings again

6. Install the adjustment rings again.



The adjustment ring is installed in a manner that the hole-pattern and the pin-pattern match.

2.1.4 Checking the rotational resistance



The rotational resistance provides information about pretensioning of the Bearing assembly. The rotational resistance depends on the series and the raceway diameter. The stiffness indirectly depends on the rotational resistance. Rule of thumb: The higher the rotational resistance, the higher the stiffness. All complete delivered Franke Bearings are set to the correct rotational resistance ex-works.

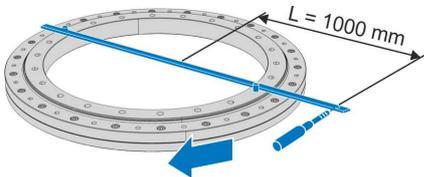


Fig. 25: Check the rotational resistance

1. Rotate bearing 2–3 times by 360° (clock-wise).
2. To check the bearing setting measure the rotational resistance **without seal** using a suitable force gage (e. g. a spring scale).



The values for the maximum rotational resistance can be seen in the diagrams in appendix B.

Notice: The diagrams only show guide values. The rotational resistance can be individually adjusted depending on application.

3. Should the rotational resistance deviate by more than 5–10 % from the desired measuring value, repeat the adjustment progress.

Installation

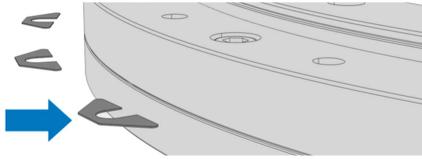


Fig. 26: Changing the adjustment shims

4. On bearings with installed adjustment shims: Should the measured value deviate, change the thickness of the adjustment shims and repeat the adjustment process.

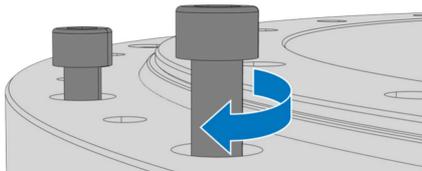


Fig. 27: Tighten screws

5. Tighten screws.



Heed tightening torque (☞ "Screw tightening torques" on page 20)!

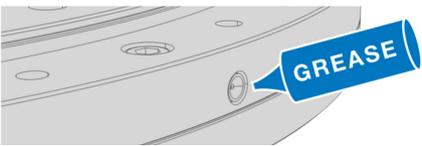


Fig. 28: Lubricate bearing

6. Lubricate bearing via the provided lubrication bore.

2.1.5 Installing the seals



Seals for Franke bearings can be ordered as accessory (product sold by meter).

Calculate seal length

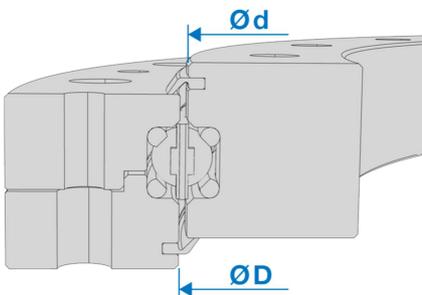
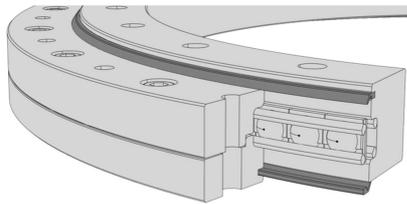


Fig. 29: Calculate seal length

1. Using the following formula, calculate the required seal length.

Installation at inner ring	$d \cdot \pi + 25 \text{ mm}$
Installation at outer ring	$D \cdot \pi + 25 \text{ m}$

Installation

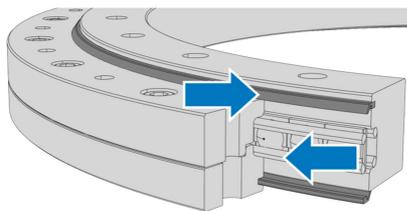


2. Determine exact seal length.



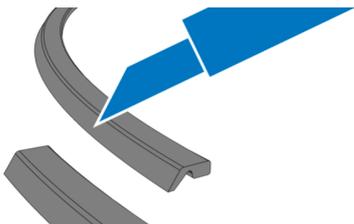
The formula to determine the seal length provides an approximate value. The final length of the seal is determined during insertion of the seal in the seal groove.

Fig. 30: Calculate seal length



3. Insert seals.

Fig. 31: Insert seal



4. Cut projecting ends of the seal to the required length.



Cut seal exactly perpendicular to the length, so precise impact points are created for adhesive bonding.

Fig. 39: Cut projecting ends

Bond seal

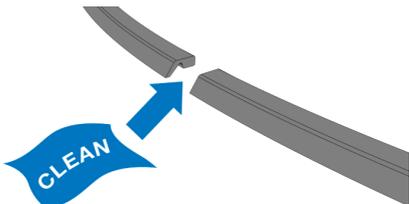


Fig. 33: Clean parting points

5. Remove seal from the seal groove and clean the parting points so they are completely grease-free.



Fig. 34: Coat parting points with adhesive

6. Coat one of the parting points with a suitable adhesive (e.g. Loctite 401).

Installation

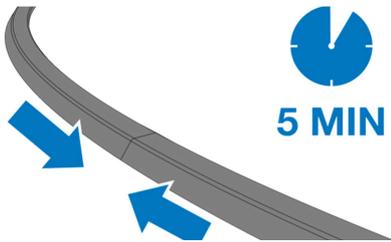
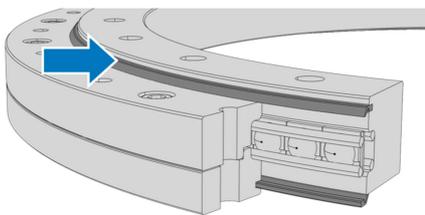


Fig. 35: Press parting points together

7. Keep parting points pressed together for about 20 seconds and let the adhesive dry/cure for 5 minutes.



8. Insert the seal in the groove again.

2.2 Installation of bearing assemblies (complete bearings)

1. Check plane surface of the connecting structure for evenness.

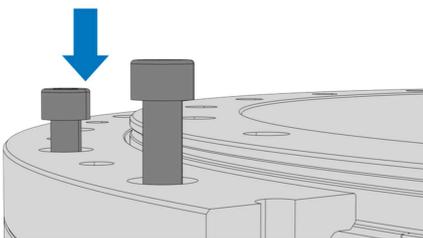


Fig. 37: Insert attachment screws

2. Lay Bearing assembly on the mounting surface and insert the attachment screws into the holes.
3. Check ease of movement of screws and the location of the holes.
4. Fasten Bearing assembly to the connecting structure.



Use prescribed screw tightening torque

2.3 Work after installation

2.3.1 Initial lubrication of bearing elements

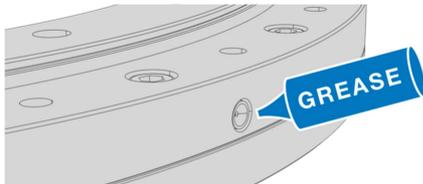


Fig. 38: Lubricate bearing

1. Calculate volume in the clearance (see 3.2.1 "Relubricating").
2. Fill 20–30 % of the lubricant via the provided lubricating holes.



On pivot bearings fill 30–40 % of the calculated clearance with lubricant via the provided lubricating holes.

2.3.2 Inspection prior to initial commissioning

- Check if all screws are tight.
- Check if the Bearing assembly is tightly screwed on.
- Turn bearing and check if it is running evenly.
- Check that the installation position is correct.
- On bearing elements check the pre-tensioning.
- If required, check gear flange play.

2.3.3 Tasks during operation

- Check for noises and vibration
- Check the bearing for damages and corrosion
- Check the attachment screws and retaining screws of the Bearing assembly for correct seat and strength
- Inspections for discharge of lubricant amounts
- Check for unusual warming/heating up

3 Maintenance

3.1 Safety instructions for maintenance

Improperly performed maintenance work

WARNING!**Danger of injury due to improperly performed maintenance work!**

- Ensure that there is sufficient assembly space.
- Make sure the assembly space is orderly and clean! Loosely-stacked components and tools or those left lying around are a source of accidents.
- If components have been removed, make sure they are assembled correctly, re-fit all fastening elements and adhere to screw tightening torques.
- When cleaning the bearing use a suitable detergent that is compatible to the seal. See detergent manufacturer information.
- Before recommissioning, heed the following points:
 - Make sure that all maintenance work is performed and completed according to the details and instructions in these instructions.
 - Make sure there are no people in the danger zone.
 - Make sure that all covers and safety equipment are installed and functioning properly.

Faulty maintenance

NOTICE!**Property damages due to faulty maintenance!**

- Check the Bearing assembly every six month for corrosion.
- Depending on usage (e.g. during vibration influence) retighten the screw connections in regular intervals.
- When hearing running noise from the bearing switch off the machine and determine fault.
- Check the seals of bearing on a regular basis.

Wrong lubrication

NOTICE!**Property damages due to improper lubrication!**

- Only use lubricants approved by the manufacturer (☞ *Chapter 5.1 "Permitted Lubricants"*).
- Heed the relubrication amounts and relubrication intervals (☞ *Chapter 33.2.1 "Relubricating"*).
- Only relubricate the bearing at operating temperature.

Environmental protection

- At all lubrication points that are supplied with lubrication, remove the escaping, used or excess grease and dispose of it according to the valid local regulations.

3.2 Maintenance work

3.2.1 Relubricating

Lubricant



Use fully synthetic lubricants for long-term lubrication due to non-aging characteristics. Franke recommends the fully-synthetic special lubricant "SHELL gadus S3 V220 C2.

NOTICE!

Property damage due to improper lubrication!

- Ensure that the lubricants are suitable for the respective usage case and for the materials used (e.g. ball bearing cage or seal).
- When mixing lubricants, consider the compatibility of the lubricant types. Pay special attention to base oil type, thickener, base oil viscosity and NGLI class. These questions must be addressed in advance with the lubricant manufacturer, especially if the bearing is used under extreme operating conditions.

Relubricate bearing

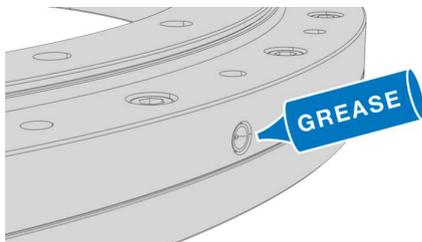


Fig. 39: Lubricate bearing

1. Relubricate while the bearing has operating temperature.
2. When relubricating turn the bearing.



The relubrication period is application-specific. The following table shows guide values.

Relubrication interval

Circumferential speed v_u in [m/s]	Relubricating interval in hours (h)
0 to < 3	5000
3 to < 5	1000
5 to < 8	600
8 to < 10	200

Maintenance

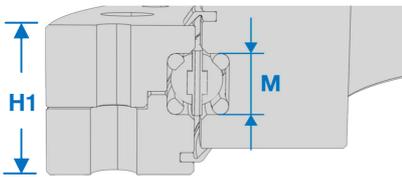


Fig. 40: Wire bed height

- If relubrication frequency is determined, calculate the relubrication amounts using the following formula.

Calculation of the relubrication amount on Bearing elements

$$m = \text{KK}\varnothing * (M * 2) / 3 * x$$

m = relubrication amount in grams

$\varnothing\text{KK}$ = ball ring diameter

M = wire bed height in millimeter

x = factor x in mm^{-1} according to the table for relubrication amounts

Calculation of the relubrication amount on Bearing assemblies

$$m = \text{KK}\varnothing * (h_2/3) * x$$

m = relubrication amount in grams

$\varnothing\text{KK}$ = ball ring diameter

H₁ = bearing ring height in millimeter (inch)

x = factor x in mm^{-1} according to the table for relubrication amounts

Relubrication	x in [mm^{-1}]
Weekly	0.002
Monthly	0.003
Annually	0.004
Every 2–3 years	0.005



When lubricating gear tooth bearings, an automatic gear lubrication is required. When lubricating manually, lubricate the gear tooth system and pinion gears prior to commissioning.

Always contact our customer service for any questions.

Calculation example for standard Bearing assemblies

Bearing assembly of the LVA type

- $\varnothing_{KK} = 500 \text{ mm}$
- Bearing ring height $H_1 = 42 \text{ mm}$
- Circumferential speed: 3 m/s
- On-period: about 16 hours per day

The table shows a relubrication interval of 1000 hours for the circumference speed of 3 m/s .

$1000 \text{ (h)} * 16 \text{ (h/day)} = 63 \text{ days (3 month)}$. This means, the bearing must be relubricated every three month. As factor for the relubrication amount, the factor $x = 0.003$ is derived from the table.

The dimension h_2 is, according to the catalog, 42 mm .

This provides for the calculation of the lubricant amount:

$$M = 500 \text{ mm} * (42/3 \text{ mm}^{-1}) * 0.003 \text{ g} = 42 \text{ g}$$

3.2.2 Retightening the screw connections

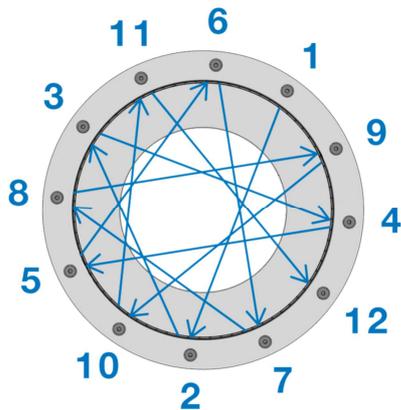


Fig. 41: Tighten screws cross-wise

1. Using a torque wrench tighten the screws cross-wise at the prescribed tightening torque.



The selection of the attachment screws is determined by the design engineer.

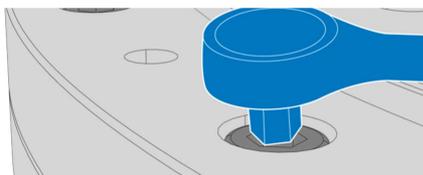


Fig. 42: Tighten screws

2. Check screws after about 100 operating hours for signs of settling. If required, retighten screws.
3. Thereafter check the screws every 600 operating hours. The time period decreases under special operating conditions (e.g. vibrations).

Tools and accessories

Screw tightening torques

Screw size	Torque in [Nm]	
	Property class 8.8	Property class 12.9
M6	10	17
M8	25	41
M10	49	83
M12	86	145
M14	210	355

3.2.3 Checking and replacing the seal

1. Check the seal every six month for cracks and damages.

To change a seal proceed as follows:

1. If required, disassemble the Bearing assembly.
2. Carefully pull the seal from the groove.
3. If required, determine the seal length.
4. Replace the seal (↪ *Chapter "2.1.5 Installing the seals" on page 12*).
5. Install the Bearing assemblies again.

4 Tools and accessories

4.1 Required tools

- Torque wrench
- Dial gage
- Hexagon socket bolt
- Screwdriver
- Flat round grinding machine (for massive adjustment)
- Feeler gage
- Spring scale (or similar)
- Lever for measuring the torque

4.2 Accessories

The following accessory is optionally available:

- Adjustment shims
- Seals
- Spare balls (Quality class 3 according to DIN 5401) for bearing elements
- Retaining screws



For further information refer to the manufacturer catalog.

5 Technical Data



The technical data of the respective Bearing assembly can be found in our product catalog. The following table shows the recommended lubricants.

5.1 Permitted lubricant

Manufacturer	Type
Shell	Gadus S3 V220 C2
BP	ENERGREASE LS-EP 2
Texaco	Multifak EP 2
Exxon	Mobilux EP 2
And comparable.	

5.2 Marking of bearing



Each bearing is marked with the parts number, serial number as well as calendar week and year of manufacturing.

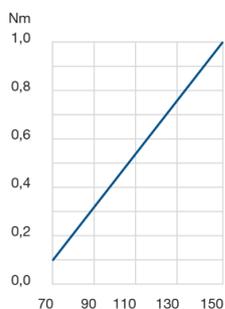
6 Appendix

A Rotational resistance of the bearing elements / slim bearings

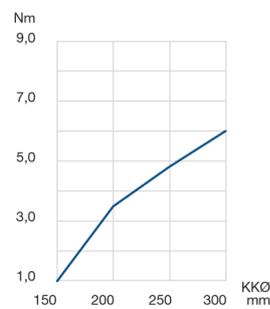


The rotational resistance provides information about pretensioning of the Bearing assembly. It depends on the respective type and the race diameter. These values are however not definitive and therefore individually adjustable depending on application. The stiffness indirectly depends on the rotational resistance. Rule of thumb: The higher the rotational resistance, the higher the stiffness.

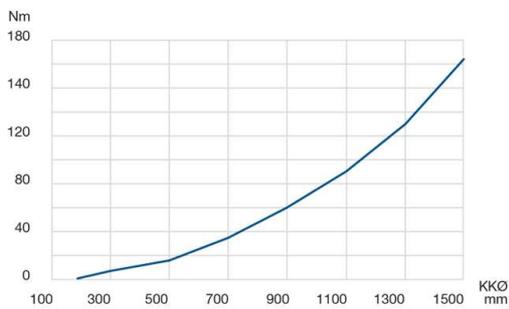
Tvoe LEL 1.5



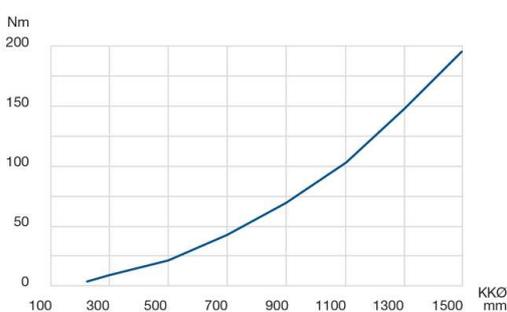
Tvoe LEL 2.5



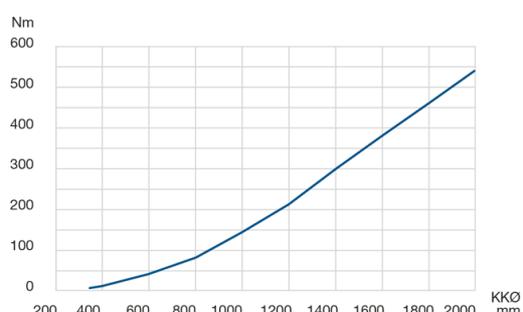
Tvoe LEL 4



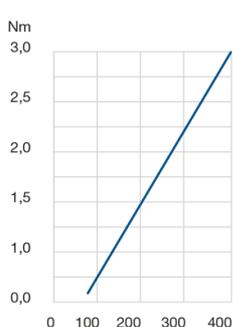
Type LEL 5



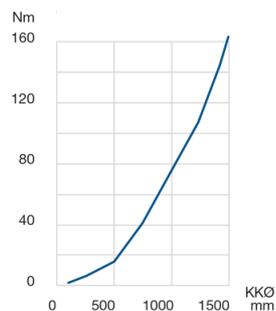
Type LEL 7



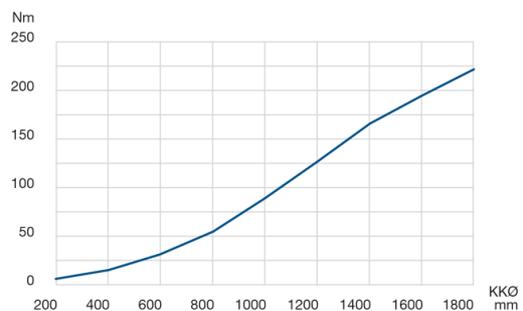
Type LER 2



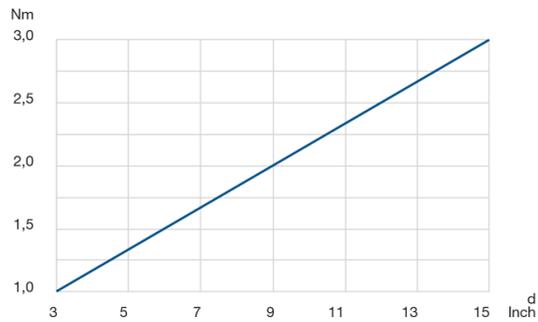
Type LER 3



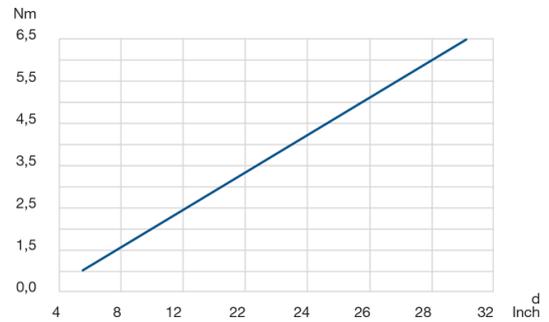
Type LER 4, LER 5



Type LSA 4, LSA 6



Type LSA 8

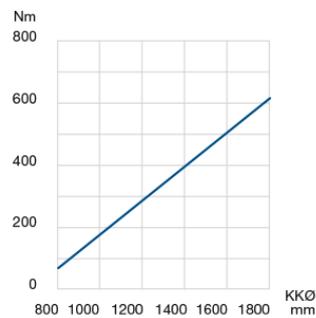
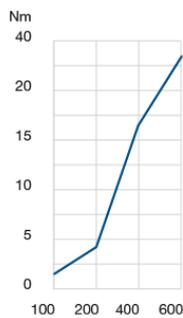


B Rotational resistance of bearing assemblies

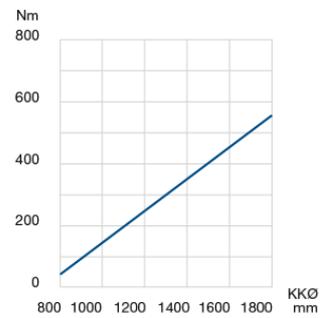
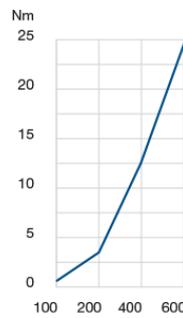


Radial and axial accuracy as well as rotational resistance correspond directly to the cross section of the bearing and the material of the mating structure.

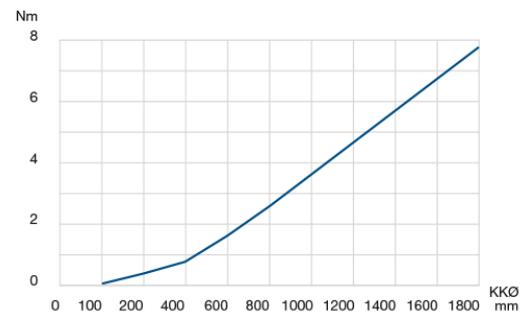
Type LVA, LVD



Type LVB, LVE



Type LVC



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VML Montage L E

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