Technical Information
Wire Race Bearings

1 Wire Race Bearing selection

The ideal selection, i.e. selection of bearings should take place before the start of design. The underlying question is which bearing series will delver the greatest benefits in the respective application:

- Bearing elements (type LEL, LER):
  - Maximum possible integration capacity
  - Series application to meet cost constraints
  - Greatest possible flexibility based on preload, runnability and diameter ranges
- Slim bearings (type LSA, LSB, LSC):
  - Simple, compact integration within your designs
  - Cost-effective alternative to standard slim bearings
  - Not preloaded bearings
- Bearing assemblies (type LVA, LVB, LVD, LVE):
  - Ready-to-use standard bearings with a large selection range
  - Preloaded free from clearance (optimized for rigidity, speed and service life)
  - Available on short notice
- Bearing assemblies (type LVC):
  - Ready-to-use standard bearings for high rotational speeds
- Rotary systems (type LTA):
  - Robust, standard rotary table with worm drive for handling and standard positioning tasks at high speed
- Rotary systems (type LTB):
  - Rotary table with worm gear for highly accurate measurement and positioning tasks

1.1 Parameters to select bearings

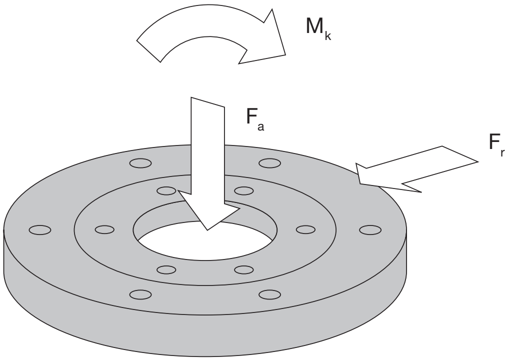
- Proper dimensions and material information of bearings
- Loads with load collectives and corresponding time quotients in %
- Rotational speed, i.e. number of swinging movements and swing angles per time unit
- Circumferential forces that the gear transfers
- Other operating conditions such as temperature, vacuum, clean room, moisture, etc.

An approximate bearing selection is possible based on our calculation formulae. The relevant data on this are found on the individual type pages.

1.2 Static and dynamic load-bearing capacity – calculation

The details listed in the catalogue concerning static and dynamic load rating are sufficient for initial design, but not for scaling. The load ratings mentioned are the radial load ratings. The static axial radial moment load ratings, i.e. the dynamic axial and radial load ratings are required to deliver ideal design. The axial values are higher by approx. facto 2.

2 Calculation



All forces and moments acting on the bearing must be summarised in centrally prevalent forces F_a and F_r, also the consequent moments M_a, by vector addition. We would be pleased to make the calculation on your behalf for complex load incidences and load collectives with changing load and speed.

2.1 Terms, dimensions

C	dynamic rated load	(N)
C_0	static rated load	(N)
F_a	centrally-acting axial force	(N)
F_r	centrally-acting radial force	(N)
KKØ	ball pitch diameter = (D + d)/2	(M)
L_n	nominal service life	(h)
M_k	tilting moment	(Nm)
n	Number of revolutions	(min^{-1})
P	dynamic equivalent load	(N)
P_0	static equivalent load	(N)
S_{st}	static safety	
X	radial factor	
Y	axial factor	
Z	moment factor	

2.2 Static calculation

A static calculation is sufficient if the bearing is at rest or is subject to load at low rotational and swinging movement with a circumferential speed in the ball pitch of V ≤ 0.1 m/s.
A bearing with sufficient load-bearing capacity would be chosen once the recommended static safety is reached.

$$S_{st} = \frac{1}{\frac{Fa}{Coa} + \frac{Fr}{Cor} + \frac{M}{Com}} \qquad (-)$$

2.2.1 Axial and radial factors

	X_0	Y_0
All bearing types	1.0	0.47

2.2.2 Recommended Static safety S_{st}

Ball diameter > 6	S_{st}
During smooth operation without vibration	> 1.8
During normal operation	> 2.5
During pronounced impact loads and high requirements concerning run accuracy	> 8

2.3 Dynamic calculation

A circumferential speed of v > 0.1 m/s will require a static and dynamic calculation, in which the static safety S_{st} must at least reach the recommended value for each load.

2.3.1 Nominal service life

$$L_h = \left(\frac{C}{P}\right)^3 \cdot \frac{10^6}{60 \cdot n} \qquad (h)$$

2.3.2 Axial and radial loads

$$P = X \cdot FR + Y \cdot F_a \qquad (N)$$

	$\frac{F_a}{F_r} \ge 1$		$\frac{F_a}{F_r} < 1$	
	X	Y	X	Y
All bearing types	1.26	0.45	0.86	0.86

2.3.3 Axial and moment load and axial load with $F_r = 0, M_k = 0$

$$P = Y \cdot F_a + Z \cdot \frac{M_k}{\text{KKØ}} \qquad (N)$$

	$0 < \frac{M_k}{F_a \cdot \text{KKØ}} \le 0.5$		$\frac{M_k}{F_a \cdot \text{KKØ}} \le 0.5$	
	Y	Z	X	Z
All bearing types	0.86	1.72	0.45	2.54

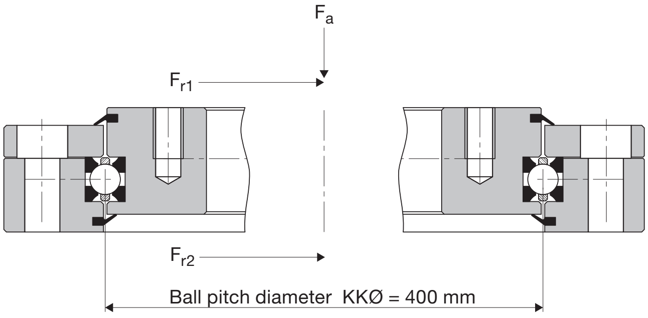
2.3.4 Radial and moment load and radial load with $F_r = 0, M_k = 0$

$$P = X \cdot F_r + Z \cdot \frac{M_k}{\text{KKØ}} \qquad (N)$$

	$0 \ge \frac{M_k}{F_r \cdot \text{KKØ}} \le 0.5$		$\frac{M_k}{F_r \cdot \text{KKØ}} \ge 0.5$	
	X	Z	X	Z
All bearing types	1.0	1.68	0.86	1.96

We are pleased to conduct the calculation on your behalf for the load case radial, axial and moment load.

3 Calculation example of bearing elements



Load data:
Load case A (static load)

Central axial force consisting of net weight + load	F_a = 22 kN
Radial force from working pressure	F_{r1} = 4.2 kN

Load case B (dynamic load)

Central axial force consisting of net weight + load $F_a = 22$ kN

Radial force from drive $F_{r2} = 1.5$ kN

Average operating speed $n = 9.5$ 1/min

Calculation for bearing element LEL 4 with KKØ 400 mm.

Data: $C_{0a} = 240$ kN
$C_{0r} = 113$ kN

Calculation:

Load case A (static load)

$$S_{st} = \frac{1}{\frac{Fa}{Coa} + \frac{Fr}{Cor} + \frac{M}{Com}} = \frac{1}{\frac{22}{240} + \frac{4,2}{113} + \frac{-}{-}}$$

Safety S_{st} = 7.8 (sufficient for bearing in normal operation)

Load case B (dynamic load)

$$S_{st} = \frac{1}{\frac{Fa}{Coa} + \frac{Fr}{Cor} + \frac{M}{Com}} = \frac{1}{\frac{22}{240} + \frac{1,5}{113} + \frac{-}{-}}$$

Safety S_{st} = 9.5 (hence greater than the required minimum safety under 2.2.2)

Service life $L_h = \left(\frac{29}{20.2}\right)^3 \cdot \frac{10^6}{60 \cdot 9.5} = 5200$ h

$(P = 0.86 \cdot 1.5 \text{ kN} + 0.86 \cdot 22 \text{ kN} = 20.2 \text{ kN})$

4 Design and production of the bearing bed

Bearing elements consist of two bearing elements and a multi-part, segmented cage with balls. The race rings are open; their diameter can therefore be altered elastically for mounting.

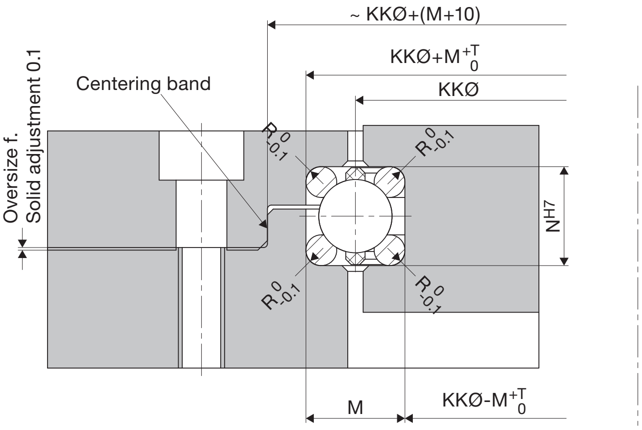
The balls satisfy quality class 3 (DIN 5401). Only use the balls contained in the delivery. If balls are lost, please replace all other balls also to avoid impeding the runnability of the bearing.

Design and ideal technical production, also the correct setting of preload, are important conditions in ensuring long service life. This guarantees that all raceways are involved in accommodating the load and that the balls run ideally on their predefined positions.

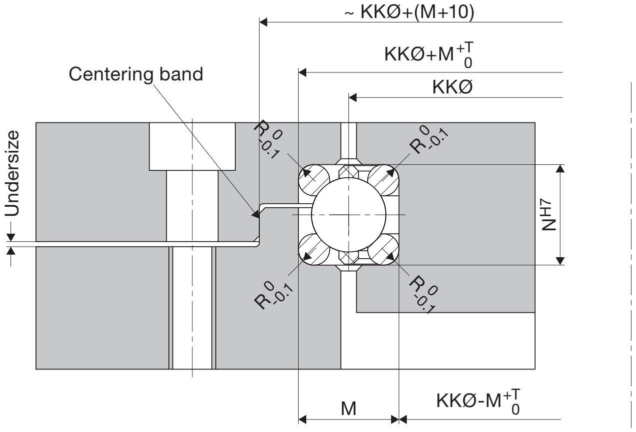
The design and production of the wire bed differs for the individual bearing elements and slim bearings; the following contains corresponding descriptions.

4.1 Wire bed design for bearing elements type LEL
The bearing elements LEL offer the best runnability and running accuracy, but also place the highest demands in design of the wire bed. Here are two scaled diagrams for the most important parameters:

1. Adjustment through grinding (sold adjustment)
It is important to take care in the design of the mating components that the housing parts to be joined together are manufactured with oversize to achieve the desired preload in the bearing by grinding the lid.



2. Adjustment using washers
It is important to take care in the design of the mating components that the housing parts to be joined together are manufactured with undersize to achieve the desired preload in the bearing by adding washers.



The dimensions and tolerances are calculated as follows:
R = λ – 0.1
T = KKØ / 10,000 (dimensions in mm)
Oversize for grinding, i.e. undersize for additional washers: 0.1 mm
Fit tolerance for central fit

Bore:	lower tolerance:	+0.01;
	upper tolerance:	+0.01 +IT6
Shaft:	upper tolerance:	–0.01;
	lower tolerance:	–0.01 –IT6

In a design sense it is worthwhile to create a separated bearing stator, but the rotor should generally comprise one part only. The individual accuracies influence the required accuracy; accordingly, separated rings should be apportioned ⅔ of the radial/axial tolerances, while singe-part rings are apportioned half of the radial/axial tolerances.

Half of the diameter tolerance principally applies to the roundness of the wire bed; the screw-on surface of the connecting construction applies to the axial runout. The center of the wire bed is always the basis for the radial runout. Evenness and parallel quality of the individual components are designed with one half of the overall tolerance.

Take care when designing the mating components that the parallel surfaces that are not joined (e.g. surface above the centering band) is designed with a sufficient interval to ensure they have sufficient space once the bearings have been adjusted. Design the chamfers and radii on the fit in such a way that the joint surfaces can be screwed together without collisions occurring in the area of the cylinder edges.

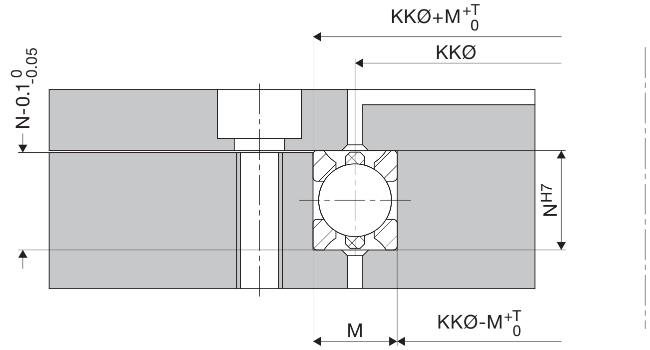
In general it is true that the accuracy of the bearing assembly is improved if the wire bed of the separated ring is manufactured once the two rings have been screwed together and dowelled using pins. Further, the mounting fit of the bearing must be processed together with the wire bed in one setting. It is sufficient to manufacture the wire bed by means of machining or milling; the recommended surface qualities are < Ra 3.2, as high surface quality has a positive influence on the settling behavior of the bearings.

The wire bed should always be processed in one setting with contours correlated with the centering or runnability; this helps achieve ideal accuracy and service life of the bearing. We recommend protecting the wire bed against wear if soft materials are used (e.g. by anodizing or chemical nickel-plating, etc.).

4.2 Wire bed design for bearing elements type LER

The bearing elements LER offer significantly greater simplicity compared with the LEL series in terms of the mating rotary components. Here it is possible to adjust the bearing using a simple lid plate and washers. Like with the LEL, the wire bed must be separated, and centering of the separated ring is not necessary.

It is important to take care in the design of the mating components for systems with lid that the wire bed fitted with lid is manufactured undersized; this ensures that through addition of washers, the desired preload in the bearing can be reached.



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The information provided in the LEL section applies to the constructive design. The wire bed does not possess any radii that accommodate the race ring, but the tool radii must not be greater than 0.2 mm.

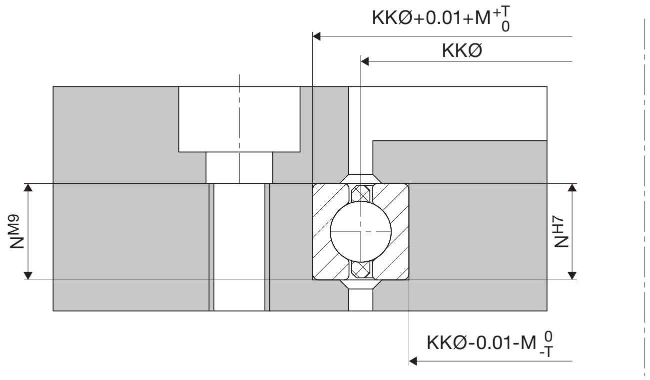
T = KKØ/10.000 (dimensions in mm)
Undersize for washers: 0.1 mm

In a design sense it is worthwhile to create a separated bearing stator, but the rotor should generally comprise one part only. The individual accuracies influence the required accuracy; but seeing as the wire bed of the separated ring is also not offset radially, the radial and axial tolerances are divided evenly between the two rings.

Half of the diameter tolerance principally applies to the roundness of the wire bed; the screw-on surface of the connecting construction applies to the axial runout. The center of the wire bed is always the basis for the radial runout.

Evenness and parallel quality of the individual components are designed with one half of the overall tolerance.
The mounting fit of the bearing must be processed together with the wire bed in one setting. It is sufficient to manufacture the wire bed by means of machining or milling; the recommended surface qualities are < Ra 3.2, as high surface quality has a positive influence on the settling behavior of the bearings.

4.3 Wire bed design for slim bearings type LSA
Unlike the bearing elements LEL and LER described above, the LSA bearing elements cannot be adjusted and always come with clearance. According to the specifications listed below, the bearings have a clearance of between 0.02 and 0.08 mm. The wire bed is separated like with the LER; it is not possible to set the clearance.



It is sensible in the constructive design to integrate the outer ring in the separated element of the mating structure, given that assembly, and specifically insertion of the ring in the mating structure, is easier to manage in this way.

The wire bed does not possess any radii that accommodate the race ring, but the tool radii must not be greater than 0.2 mm.
T = IT7 for KKØ up to 250 / IT6 for KKØ larger than 250 (dimensions in mm)

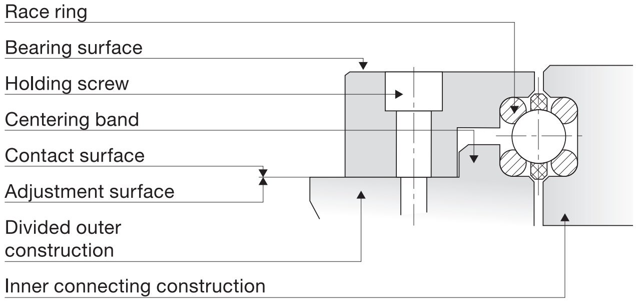
Half of the diameter tolerance principally applies to the roundness of the wire bed; the screw-on surface of the connecting construction applies to the axial runout. The center of the wire bed is always the basis for the radial runout.

The mounting fit of the bearing must be processed together with the wire bed in one setting. It is sufficient to manufacture the wire bed by means of machining or milling; the recommended surface qualities are < Ra 3.2, as high surface quality has a positive influence on the settling behavior of the bearings.

5 Assembly

5.1 Installation and adjustment of bearing elements

5.1.1 Setting using washers
Setting the washers is the most economical and flexible procedure, as it also permits downstream alteration of the rotational resistance. Washers in a variety of thickness can be ordered, dependent on the diameter of the screws (see Accessories p. 67).



Requirements:

- Separation of the inner or the outer ring construction.
- The height of the race ring bed is smaller on one side of the separated connecting construction: 0.3 to 0.5 mm. This gap is needed to accommodate the washers.
- The separated side of the connecting construction should be fixed in place using a centering band. This is the only means of ensuring that the raceways run parallel.

Installation and setting:
The race rings are inserted in the mating structure. Coat the race ring beds with grease to keep the race rings in position during installation. The joints on the opposing race rings in the same component are installed, each offset by approx. 180°. The separated part of the connecting construction is then installed in its intended position.*

The cage elements with the balls are then inserted, and the bearing element is greased (see 6.1 Lubrication and maintenance). Before closing the mating structure in the separated side it is important to place the washers on the drill holes of the retaining screws. The thickness is dependent on the constructed gap (see above).

Check the rotational resistance once the screws have been tightened (see 6.5 Screw connections) and the bearing assembly has been rotated approx. 2 to 3 times by 360°. Change the thickness of all washers and repeat the process if the measurement value deviates by more than 5 to 10 %.

*Applies to both setting methods: 2.1 and 2.2.

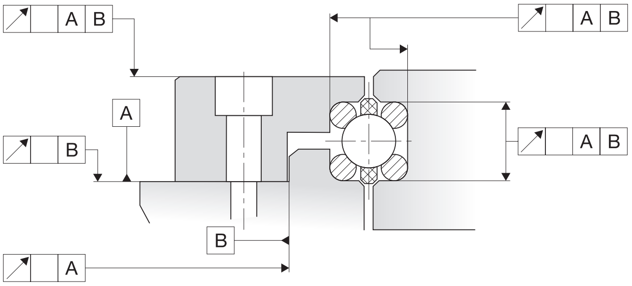
5.1.2 Setting using solid adjustment

When making the setting by means of solid adjustment, the correct dimensions of the adjustment surface are produced by grinding. This method delivers the best accuracies as the separating surface between the separated side of the connecting construction is flush and stress transmission cannot emerge.

Prerequisite:

- Separation of the inner or the outer ring construction.
- Flange grinding machine in a suitable size.
- The height of the race ring bed on the side of the separated connecting construction is 0.1 mm larger. This oversize is needed for adjustment.
- The separated side of the connecting construction should be fixed in place using a centering band. This determines the parallel nature of the two raceways

Installation and setting:
Then the cage segments with the balls are inserted and the bearing assembly is closed with the second separated part of the mating structure (adjustment ring). Use a dial gage to measure the clearance between the inner and outer ring once the screws have been tightened as specified (see 6.5 Screw connections) and the bearing assembly has been rotated approx. 2 to 3 times by 360°. The adjustment ring is then dismantled again and the measurement value registered plus 0.02 to 0.03 mm is ground down using the flat grinder.



A suitable support surface should be selected as early as the design phase to ensure parallel adjustment between this surface and the raceway support. The ring is fitted and the bearing moved as described above once the grinding dust has been thoroughly removed. Then check the rotational resistance. The process must be repeated if this measurement value deviates by more than 5 to 10 %. Finally the bearing assembly is lubricated using the fitted lubricant bores (see 6.1 Lubrication and maintenance).

The bearings are designed for continuous operation at temperatures between –10 °C and +70 °C – briefly also for use at up to +120 °C. Circumferential speeds of 10 m/s with grease lubrication and 12 m/s with oil lubrication can be achieved. Setting the preload is an important condition for a long service life of the bearing element. The preload guarantees that all raceways are involved in accommodating the load and that the balls run ideally on their predefined positions. Preload is set correctly if the rotational resistance without seals matches the values in the diagram under item 6.

Note: Setting the preload is advisable as tolerances will exist and require compensation even in the event of ideal production.

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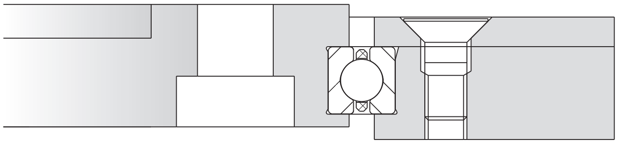
5.2 Installation and adjustment of slim bearings

Slim bearings type LSA

The LSA is a consistent redevelopment of the Wire Race Bearing technology. In LSA two race wires are combined into one. Instead of the four race rings you find in conventional Wire Race Bearings, the LSA has just two. The 4-point principle is maintained by the special profile of the raceways. This makes mounting and adjustment just as simple as for conventional slim bearings with gains in load bearing capacity and rating. Assembly takes place according to the following stages:

1. Clean the components with a clean cloth that does not lint.
2. Grease the race rings (rear side).
3. Insert the inner ring of the LSA into the inner ring of the mating structure. Take care that a gap separates the ends of the race ring ends.
4. Place the cage and the outer race ring on the inner race ring. Hold together the ends of the outer race ring in such away that the ball cage cannot slip out.
5. Position and axially insert the outer ring.
6. Position and screw on the lid.

Installation proposal:



Slim bearings type LSB

Slim bearings of the type LSB are highly resilient, ready-to-use Wire Race Bearings that can be fitted very easily and in a compact mounting space. In slim bearings LSB the bearing element (four ball race rings with ground raceway and with retained balls) is embedded in an inner and outer sleeve made of steel. The sleeves are separated circumferentially and form a ready-to-fit bearing that is directly integrated in the respective design. Unlike standard closed and ground slim bearings, the clearance in Franke slim bearings is not dependent on adjusting the seat of the outer and inner ring. Therefore the installation and dismantling are easier and do not require special tools or thermal treatment.

The bearings are designed for continuous operation at temperatures between –10 °C and +70 °C – briefly also for use at up to +100 °C. Circumferential speeds of 10 m/s with grease lubrication and 12 m/s with oil lubrication can be achieved. Setting the preload is an important condition for a long service life of the slim bearing. The preload guarantees that all raceways are involved in accommodating the load and that the balls run ideally on their predefined positions.

Preload is set correctly if the rotational resistance without seals matches the values in the diagram under item 6.

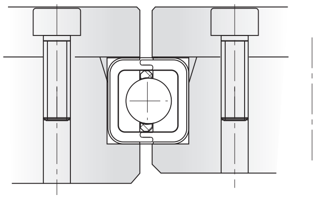
Note: Setting the preload is advisable as tolerances will exist and require compensation even in the event of ideal production.

Slim bearings type LSC

Slim bearings type LSC consist of a slim bearing type LSA (techn. Info see above), which is embedded in elastomer sleeves. These sleeves ensure the sealing of the bearing and simultaneously take over adjustment and tolerance compensation. Slim bearings type LSC therefore must not be adjusted after mounting.

The installation involves the following steps:

1. Clean components with a clean, lint-free cloth.
2. Grease either elastomer sleeves or cylindrical surface of the mating structure.
3. Carefully insert the bearing without twisting the elastomer.
4. Put on the cover and screw it.



5.2.1 Setting using washers

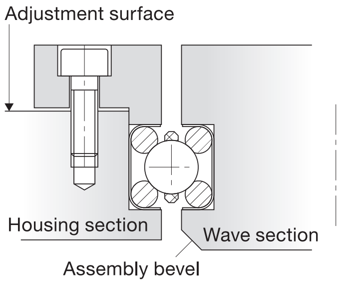
Setting the washers is the most economical and flexible procedure, as it also permits downstream alteration of the rotational resistance. Washers in a variety of thickness can be ordered, dependent on the diameter of the screws (see Accessories p. 67).

Requirements:

- Separation of the inner or the outer ring construction.
- The height of the race ring bed is smaller on one side of the separated connecting construction: 0.3 to 0.5 mm. This gap is needed to accommodate the washers.
- The separated side of the connecting construction can be fixed in place using a centering band to improve parallel adjustment of the raceways.

Installation proposal A:

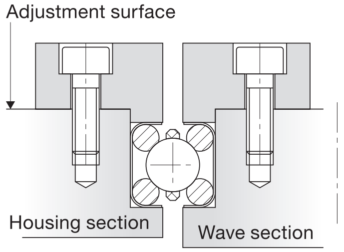
The slim bearing is inserted in the connecting construction. Before closing the connecting construction in the separated side, the washers are fitted on the drill holes of the retaining screws. The thickness is dependent on the constructed gap (see above). Check the rotational resistance once the screws have been tightened (see 6.5 Screw connections) and the bearing assembly has been rotated approx. 2 to 3 times by 360°. Change the thickness of all washers and repeat the process if the measurement value deviates by more than 5 to 10 %.



5.2.2 Setting using solid adjustment
When making the setting by solid adjustment, the correct dimensions of the adjustment surface are produced by grinding. This method delivers the best accuracies as the separating surface between the separated side of the connecting construction is flush and stress transmission cannot emerge.

Prerequisite:
- Separation of the inner or the outer ring construction.
- Flange grinding machine in a suitable size.
- The height of the wire bed on the side of the separated connecting construction is 0.1 mm larger. This oversize is needed for adjustment.
- The separated side of the connecting construction can be fixed in place using a centering band. This improves the parallel adjustment between the two raceways.

Installation and setting:
The slim bearing is inserted in the connecting construction and the bearing is closed with the second separated part of the mating structure (adjustment ring). Use a dial gage to measure the clearance between the inner and outer ring once the screws have been tightened as specified (see 6.5 Screw connections) and the bearing has been rotated approx. 2 to 3 times by 360°. The adjustment ring is then dismantled again and the measurement value registered plus 0.02 to 0.03 mm is ground down using the flat grinder. A suitable support surface should be selected as early as the design phase to ensure parallel adjustment between this surface and the raceway support. The ring is fitted and the bearing moved as described above once the grinding dust has been thoroughly removed. Then check the rotational resistance. The process must be repeated if this measurement value deviates by more than 5 to 10 %.



6 Installation and setting of bearing assemblies

Franke bearing assemblies are ready-to-use complete bearings – no matter whether they are standard bearings from the catalogue or customer-specific versions. The specified or defined run accuracy, rotational resistance, rigidity and general properties are dependent on both the connecting construction and on the accuracy and completeness of the data provided. For this reason these are particularly important factors.

6.1 Lubrication and maintenance
Sufficient lubrication is necessary in order to keep friction low and to permanently protect the bearing against corrosion. All lubricants age in a manner that limits their suitability for use. Fully synthetic lubricants deliver the best age-resilience. Use ISOFLEX TOPAS NCA52 (special grease by the firm Klüber, designation according to DIN 51502 is: KHC2 N-50) to lubricate Franke bearings for the first time. The age-resilience of this lubricant is approximately three years. This lubricant is also recommended for use in the bearing elements.

High-quality lithium soap greases on a polyalphaolefine basis or mineral oil basis, i.e. according to DIN 51825-K2 K-40, are suitable as alternatives. Please clarify any questions concerning lubricants, e.g. mixability, aggressiveness, extreme temperatures, disposal, areas of use and such like, with the respective manufacturer.

6.2 Initial lubrication resp. re-newed lubrication
The lubricant quantity that a Wire Race Bearing requires for lubrication is relatively low and adjusts automatically depending on the speed. If the lubricant quantity is too high, the creep may produce elevated temperatures that restrict or eliminate the lubricating properties. The service life of the

bearing is reduced substantially by greater wear. The lubricant quantity is dependent on the calculated empty space inside the bearing assembly. The calculated volume must be filled with lubricant to 20 to 30 %. 30 to 40 % is recommended for swivel bearings.
Franke bearing assemblies are factory lubricated. Bearing elements and slim bearings are treated with anti-corrosive oil for transport and must be lubricated during assembly.

6.3 Relubrication and lubrication schedule
The lubricating capacity drops due to mechanical load and ageing. It is therefore necessary to replenish or entirely replace the existing lubricant volume (e.g. when severely contaminated). Turn the bearing during relubrication. When possible relubricate at operating temperature.

The relubrication volume is calculated as follows:
m = KKØ x H1 / 3 x X
H1 = bearing ring height in mm
KKØ = ball pitch diameter in mm
m = relubricant volume in g
X = factor according to Table 1 in mm^{-1}

Relubrication schedule: A precise definition of the schedule is dependent on the specific use and can therefore only be determined accurately by experiment (for approximate values see Table 1). Correlate the metered time with the activated application time to determine factor X (Table 2).

Note: Standard bearings only need one fitted relubrication facility, as the bearing movement itself evenly distributes the lubricant. At least three relubrication facilities are needed for swivel bearings (3 x 120°).

Vu m/s	Interval h
0 bis < 3	5000
3 bis < 5	1000
5 bis < 8	600
3 bis < 10	200

Table 1: Relubrication schedule

Interval	Weekly	Monthly	Yearly	2–3 years
X	0.002	0.003	0.004	0.005

Table 2: Relubrication intervals

Circulation lubrication with oil is essentially possible and should be coordinated with the respective lubricant manufacturer. Lubricant-free bearings are available for special applications (e.g. clean room or ultra-high vacuum).

Calculation example:
Bearing assembly type LVA, KKØ 500 mm,
Circumferential speed 3 m/s
Activation time approx. 16 h/day
The relubrication schedule for 3 m/s is 1000 h (see Table 1) = 1000 (h)/16 (h/day) = 63 days ~ 3 months for 16 h/day activation time

Relubrication should take place quarterly. Consequently, factor X (Table 2) is rounded off and amounts to 0.003. The dimensions H1 is 42 mm (see catalogue page 48).

m = 500 mm x 42 / 3 mm^{-1} x 0.003 g = 21 g
The relubrication quantity is therefore 21 g ISOFLEX TOPAS NCA52 after every three months. The lubricant has a service life of three years.

6.4 Lubrication and lubrication schedule for the gear
Automatic gear lubrication is recommended. Sufficiently lubricate the gear and sprocket by hand before commissioning. The lubrication schedule is dependent on the design and the circumferential speed and must therefore be considered individually.

6.5 Screw connections
Always check the number of screws and their diameter for attachment to the connecting construction. Interval X from retaining screw to retaining screw should not exceed 125 mm to prevent bridges developing. Tighten the fixing screws crosswise in relation to the screw quality using a torque spanner – as defined in the data contained in Table 3.

	Quality Nm 8.8	 12.9
M 6	10	17
M 8	25	41
M 10	49	83
M 12	86	145
M 16	210	355

Table 3: Tightening torque

Apply the specified tightening torque to tighten the screws in order to prevent any subsidence. When possible complete this when the screws are not exposed to any tensile forces. Inspect the screws after approximately 100 operating hours and then every 1000 operating hours thereafter. This period may also be substantially shorter for special operating conditions (e.g. exposed to severe vibration).

6.6 Gear

By standard Franke provides a straight gear without hardening (material 42CrMo4V); special gears on request. The material, design and quality can be modified at any time to suit individual wishes.

The catalogue data concerning permissible circumferential forces were determined using the permissible bending force in the tooth root. The maximum forces refer to extreme load, e.g. caused by short-term impact due to start-up or braking. These values are approximate values and can only be determined precisely by means of gear calculations accounting for both components (sprocket and bearing assembly).

6.7 Tolerances and accuracy

All tolerances and accuracies are listed on the respective catalogue pages. The greatest levels of accuracy are achieved if the constructive design of the mating parts takes place in such a way that the handling of all diameters and surfaces relating to each other can take place in one setting.
The running accuracies indicated in the catalogue are average values and may be improved by restricting the tolerances. The tolerance data T = IT6 or T = IT7 refer to the diameter-dependent basic tolerances according to DIN ISO 286 (see Table 4).

Rated dimension range mm		Basic tolerances µm	
above ...	to	IT6	IT7
80...	120	22	35
120...	180	25	40
180...	250	29	46
250...	315	32	52
315...	400	36	57
400...	500	40	63
500...	630	44	70
630...	800	50	80
800...	1000	56	90
1000...	1250	66	105
1250...	1600	78	125

Table 4: Tolerance data DIN ISO 286 T1 (11.90)

7 Rotary tables

Franke rotary tables are highly resilient and particularly suited to assembly, measurement and testing tasks. All rotary tables have a compactly structured aluminium housing with integrated Franke components. A worm gear guarantees high accuracy, even under continuous load. The rotary tables have low net weight, yet remain extremely rigid to tilting. Please find precise technical data on this in the catalogue pages.

7.1 Load-bearing capacity

The recommended safety for Franke rotary tables is $S_{st} \geq 3$ for simple load conditions and $S_{st} \geq 6$ for dynamic, alternating load and lifting conditions. Franke is pleased to calculate load and service life as required.

7.2 Temperature range

The rotary tables can be used in operating temperatures from –10 °C to +80 °C. Extended temperature ranges are available on request.

7.3 Lubrication

In general, all standard rotary tables are factory fitted with long-term lubrication using the Wire Race Bearing grease ISOFLEX TOPAS NCA52. Depending on their use, it is recommended to relubricate Franke rotary tables half yearly or yearly.

	Relubrication quantity per lubrication point g		
Lubrication point	left	front	right
LTA100		1	1
LTA200		1	1
LTB125	2		
LTB175		3	
LTB265		3	
LTB400		4	

7.4 Options

- One or two integrated inductive proximity switch(es).
- Free selection of trip cam position
- Fixtures for motors as required by customer
- Motorization with stepper or servo motor, depending on the application
- Rotary encoder fitted at the second shaft end of the worm shaft
- Complete automation solution

Please observe our assembly and maintenance instructions for each item.