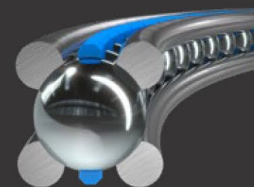


# Technical Information on Wire Race Bearings



Bearings Elements and Slim Bearings | Bearing Assemblies | Rotary Tables and Direct Drive

## 1 Wire race bearing selection

An optimum selection or dimensioning of the bearing should be made before the design work is started. The individual series offer the following advantages:

- Bearing elements (Type LEL, LER):
  - highest possible degree of integration
  - cost-sensitive series applications
  - greatest possible flexibility with regard to preload, running properties and diameter ranges
- Slim bearings (Type LSA):
  - simple, space-saving integration into your construction
  - Low-cost alternative to conventional slim bearings
  - non-preloaded bearings
  - rather subordinate quality requirements regarding accuracy and play
- Bearing assemblies (Type LVA, LVB, LVD, LVE):
  - ready-to-install standard bearings with a wide selection range
  - backlash-free preloaded (optimized with regard to stiffness, speed and service life)
  - short-term availability (partly from stock)
- Bearing assemblies (Type LVC, LVG):
  - ready-to-install standard bearing for high rotational speeds (LVC)
  - ready-to-install standard bearing for high loads (LVG)
- Rotary tables (Type LTA, LTB):
  - robust rotary table with worm drive for fast moving handling and positioning tasks (LTA)
  - rotary table with worm drive for high-precision measuring and positioning tasks (LTB)
- Bearing assemblies with direct drive (Type LTD):
  - Rotary joint with integrated torque motor for energy-efficient, highly dynamic movements

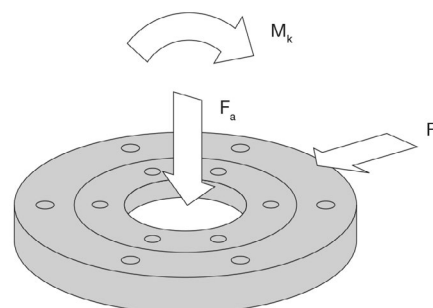
### 1.1 Parameters for bearing selection

- permissible dimensions and material information of the bearing
- loads with load spectra and associated time shares in %
- speed/number of swivel movements and angles per time unit
- peripheral forces to be transmitted by the gearing
- operating conditions (temperature, vacuum, clean room, humidity)
- required bearing life in revolutions or operating hours

### 1.2 Static and dynamic load capacity - Calculation

The basic static and dynamic load ratings stated in the catalogue are only sufficient for preliminary design. The basic load ratings shown correspond to the radial load ratings. The static axial and radial load carrying capacities or the dynamic axial and radial load carrying capacities are required for an optimum design. For more complex loads, please contact our technical sales department.

## 2 Calculation



All forces and moments acting on the bearing are to be combined by vectorial addition into centrally acting forces  $F_a$  and  $F_r$  and resulting moments  $M_a$ . For complex load cases and load spectra with variable loads and speeds, we will be pleased to calculate the values for you.

**2.1 Terms, unit of measurement**

C	dynamic load rating	(N)
C <sub>0</sub>	static load rating	(N)
F <sub>a</sub>	centrically acting axial force	(N)
F <sub>r</sub>	centrically acting radial force	(N)
KKØ	ball and cage diameter = (D + d)/2	(M)
L <sub>n</sub>	nominal lifetime	(h)
M <sub>k</sub>	tilting moment	(Nm)
n	rotational speed	(min - 1)
P	equivalent dynamic load	(N)
P <sub>0</sub>	equivalent static load	(N)
S <sub>st</sub>	static safety	
X	radial factor	
Y	axial factor	
Z	moment factor	

**2.2 Static calculation**

A static calculation is sufficient if the bearing is loaded at standstill. A bearing with sufficient load carrying capacity has been selected if the recommended static safety is achieved.

$$S_{st} = \frac{1}{\frac{F_a}{C_{oa}} + \frac{F_r}{C_{or}} + \frac{M}{C_{om}}}$$

**2.2.1 Axial and radial factors**

	X <sub>0</sub>	Y <sub>0</sub>
All bearing types	1,0	0,47

**2.2.2 Recommended static safety S<sub>st</sub>**

ball diameter > 6	S <sub>st</sub>
For quiet, vibration-free operation	> 1,8
For normal operation	> 2,5
For heavy impact loads and high demands on running accuracy	> 8,0

**2.3 Dynamic calculation**

At a circulation speed of v > 0.1 m/s, a static and dynamic calculation is required, whereby the static safety factor S<sub>st</sub> must at least reach the recommended value of the respective load.

**2.3.1 Nominal lifetime**

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

**2.3.2 Axial and radial loads**

$$P = X \cdot F_r + Y \cdot F_a \quad (N)$$

	$\frac{F_a}{F_r} \geq 1$	Y	$\frac{F_a}{F_r} > 1$	Y
All bearing types	1,26	0,45	0,86	0,86

**2.3.3 Axial and moment load and axial load with F<sub>r</sub> = 0, M<sub>k</sub> = 0**

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

	$0 < \frac{M_k}{F_a \cdot KKØ} \leq 0,5$	Z	$\frac{M_k}{F_a \cdot KKØ} \leq 0,5$	Z
All bearing types	0,86	1,72	0,45	2,54

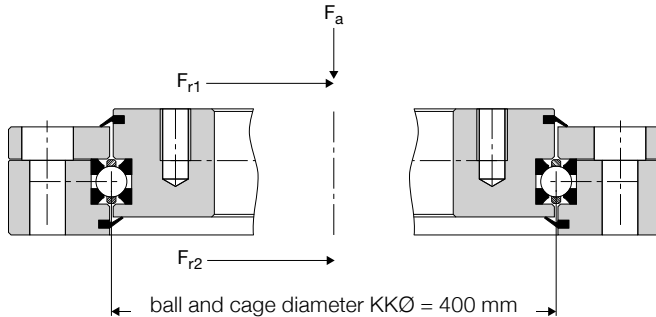
**2.3.4 Radial and moment load and radial load with F<sub>a</sub> = 0, M<sub>k</sub> = 0**

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

	$0 \geq \frac{M_k}{F_r \cdot KKØ} \leq 0,5$	Z	$\frac{M_k}{F_r \cdot KKØ} \geq 0,5$	Z
All bearing types	1,0	1,68	0,86	1,96

For radial, axial and moment loads, we will be pleased to carry out the calculation for you.

### 3 Calculation example bearing elements



#### 3.1 Load details:

##### Load case A (static stress)

Centric axial force from

Tare weight + load

$$F_a = 22 \text{ kN}$$

Radial force from working pressure

$$F_{r1} = 4,2 \text{ kN}$$

##### Load case B (dynamic stress)

Centric axial force from

Tare weight + load

$$F_a = 22 \text{ kN}$$

Radial force from drive

$$F_{r2} = 1,5 \text{ kN}$$

Average operating speed

$$n = 9,5 \text{ 1/min}$$

Calculation for bearing element LER5 with KKØ 400 mm.

Details:  $C_{0a} = 419 \text{ kN}$  und  $C_{0r} = 197 \text{ kN}$

#### 3.2 Calculation:

##### Load case A (static stress)

$$S_{st} = \frac{1}{\frac{F_a}{C_{0a}} + \frac{F_r}{C_{0r}} + \frac{M}{C_{0m}}} = \frac{1}{\frac{22}{419} + \frac{4,2}{197} + \frac{-}{-}} = 13,5$$

**Safety  $S_{st} = 13,5$**  (sufficient for normal operation)

##### Load case B (dynamic stress)

$$S_{st} = \frac{1}{\frac{F_a}{C_{0a}} + \frac{F_r}{C_{0r}} + \frac{M}{C_{0m}}} = \frac{1}{\frac{22}{419} + \frac{1,5}{197} + \frac{-}{-}} = 16,6$$

**Safety  $S = 9,5$**  (above the minimum security level specified in 2.2.2)

$$\text{Lifetime } L_h = \left(\frac{44}{20,2}\right)^3 \cdot \frac{10^6}{60 \cdot 9,5} = 18.100 \text{ h}$$

$$(P = 0,86 \cdot 1,5 \text{ kN} + 0,86 \cdot 22 \text{ kN} = 20,2 \text{ kN})$$

### 4 Design and manufacture of the bearing bed

Bearing elements consist of two inner and outer raceways and a multi-piece segmented cage with balls. The races are open and can therefore be changed elastically in diameter for installation.

The balls correspond to class G20 (DIN 5401:2002-08). Only the balls included in the delivery may be used. If balls are lost, all balls must be replaced in order not to impair the running characteristics of the bearing.

The design and technically optimum production as well as the correct setting of the preload are important prerequisites for a long service life. This guarantees that all raceways are involved in load carrying and that the balls roll optimally in the predetermined position.

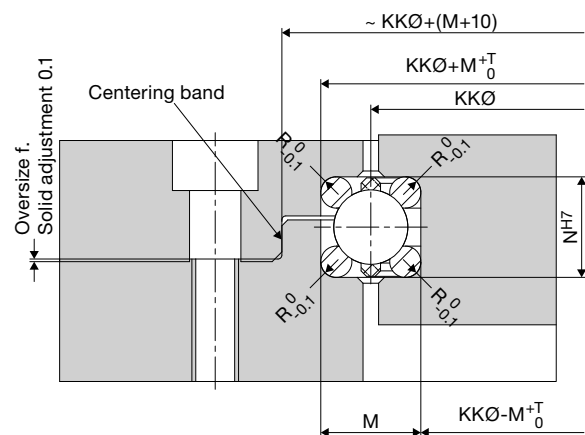
Design and manufacture of the wire bed differ for the individual bearing elements and slim bearings and are described below for these.

#### 4.1 Wire bed design for bearing elements Type LEL

The bearing elements LEL offer the highest running culture and running accuracy. They also place the highest demands on the design of the wire bed. Two dimensional sketches illustrate the most important parameters here:

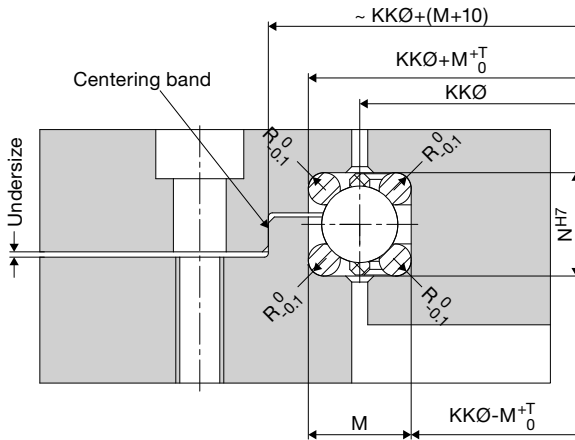
##### 4.4.1 Tuning by grinding (Massive tuning)

When designing the enclosing parts, care must be taken that the two housing parts to be joined are manufactured with oversize in order to achieve the desired preload in the bearing by grinding the cover.



## 4.1.2 Adjustment with shims

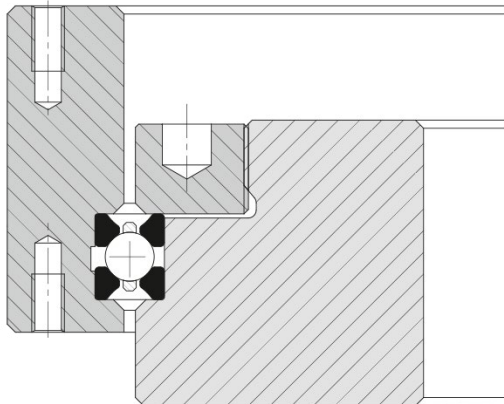
When designing the enclosing parts, it must be ensured that the two housing parts to be joined are undersized so that the desired preload in the bearing can be achieved by enclosing shims.



## 4.1.3 Adjustment with threaded ring

In this case the use of LER bearing elements is recommended. The wire bed diameters can be manufactured in one piece, then the bearing setting is adjusted by screwing in the threaded ring. This must be secured by means of a set screw after correct bearing adjustment.

With LEL bearing elements, the threaded ring must be fitted with a race to ensure sufficient concentricity.



## 4.1.4 Dimensions and tolerances

The dimensions and tolerances are calculated as follows:

$$R = \frac{\lambda}{2} - 0,1$$

$$T = KKØ / 10.000 \text{ (dimensions in mm)}$$

Grinding oversize or undersize for shims: 0.1 mm

Fitting tolerance centering fit

bore:	lower tolerance: +0,05;
	upper tolerance: +0,05 + IT6
shaft:	upper tolerance: -0,05;
	lower tolerance: -0,05 - IT6

It is advisable to design the stator of the bearing in a split design. The rotor should be made in one piece. The accuracy to be achieved is influenced by the individual accuracies, therefore it applies that split rings 2/3 receive the runout/ axial runout tolerances, the one-piece ring receives half of the runout/axial runout tolerances.

Half the diameter tolerance applies to the roundness of the wire bed. The screw mounting surface of the adjacent construction is the basis for the axial runout of the wire bed. The basis for radial runout is the wire bed centre line. Flatness and parallelism of the individual parts are designed with half the total tolerance.

When designing the enclosing parts, it must be ensured that parallel surfaces that are not joined (e.g. surface above the centring collar) are designed with sufficient clearance so that they still have clearance after the bearing has been adjusted. Chamfers and radii at the fit must be designed in such a way that the joining surfaces can be screwed together without causing collisions in the area of the cylinder edges.

Basically, it can be said that the accuracy of the bearing assembly can be improved if the wire bed of the split ring is manufactured when both rings are bolted and additionally pinned. In general, the locating fit of the bearing together with the wire bed can also be machined in one clamping. It is sufficient to manufacture the wire bed by turning or milling, in this case surface qualities of < Ra 3.2 should be aimed for, since the setting behaviour of the bearing is positively influenced by high surface quality.

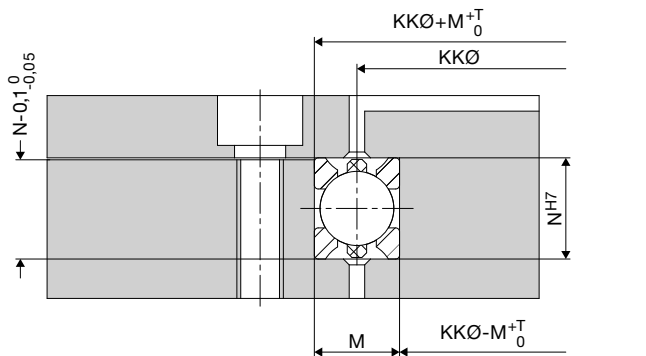
The wire bed should always be machined in one setting with the contours that are related to the centering or running accuracy, thus achieving optimum accuracy and bearing life.

For soft materials such as aluminum, we recommend protecting the wire bed against wear (e.g. by anodizing, chemical nickel plating, etc.). The layer thickness should not be less than 20µm.

## 4.2 Wire bed design for bearing elements Type LER

The bearing elements LER offer a significant simplification compared to the LEL series with regard to the production of the enclosing turned parts. Here it is possible to adjust the bearing using a simple cover plate and shims. The wire bed does not have to be split - as with the LEL - no centering on the split ring is required.

Even in the case of the design with cover, care must be taken when designing the enclosing parts to ensure that the wire bed, which is provided with cover, is manufactured with undersize in order to be able to achieve the desired preload in the bearing by enclosing shims.



The statements made in the section for LEL apply to the constructive design. The wire bed has no radii to accommodate the race, but the tool radii must not exceed 0.2 mm.

$T = KK\varnothing/10.000$  (dimensions in mm)  
Undersize for shims: 0,1 mm

It makes sense to design the stator of the bearing divided, the rotor should be one piece. The accuracy to be achieved is influenced by the individual accuracies. However, since the wire bed of the split ring also has no offset in concentricity, the concentricity and axial runout tolerances are divided equally between the two rings.

Half the diameter tolerance applies for the roundness of the wire bed, the screw mounting surface of the adjacent construction is the basis for the axial runout of the wire bed. The basis for radial runout is generally the wire bed centre line.

Flatness and parallelism of the individual parts are designed with half the total tolerance. The locating fit of the bearing is to be machined together with the wire bed in one clamping.

It is sufficient to produce the wire bed by turning or milling. Surface qualities of  $< Ra\ 3.2$  should be aimed for here, since the setting behaviour of the bearing arrangement is positively influenced by high surface quality.

## 4.3 Wire bed design for bearing elements Type LEW

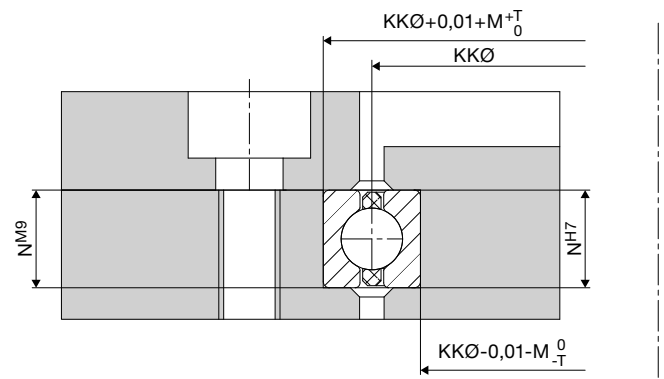
For the design of wire rod beds of bearing element series LEW, the same guidelines apply accordingly as for bearing elements of series LEL.

When ordering the bearing elements, it is absolutely necessary to specify which bearing ring will be manufactured split.

## 4.4 Wire bed design for slim bearing Type LSA

In contrast to the bearing elements described above, the bearing elements LSA are not adjustable and are always subject to play. According to the following specifications, the resulting bearing arrangements have play between 0.02 and 0.12 mm. As with the LER, the wire bed is undivided, and adjustment of the play is not possible.

When designing, it makes sense to integrate the outer ring into the split element of the surrounding structure, as this makes it easier to insert the ring into the surrounding structure.



The wire bed has no radii to accommodate the race, but the tool radii must not exceed 0.2 mm.  $T = 0.03$  mm for KK up to 300 | 0.04 mm for KK greater than 300 (mm).

Half the diameter tolerance applies for the roundness of the wire bed, the screw mounting surface of the adjacent construction is the basis for the axial runout of the wire bed. The basis for radial runout is generally the wire bed centre line.

The locating fit of the bearing must be machined together with the wire bed in one clamping. It is sufficient to produce the wire bed by turning or milling, in this case surface qualities of  $< Ra\ 3.2$  should be aimed for, since the setting behaviour of the bearing arrangement is positively influenced by high surface quality.

## 5 Assembly

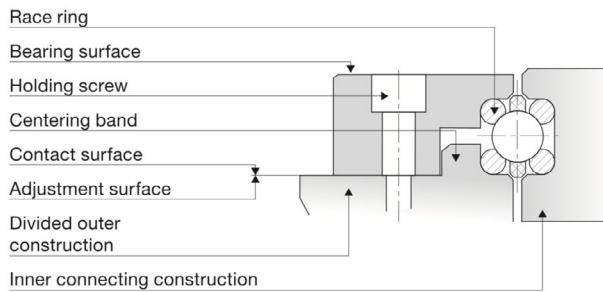
### 5.1 Installation and adjustment of bearing elements

#### 5.1.1 Adjustment with shims

Adjustment with shims is the most economical and flexible procedure, since subsequent changes to the rotational resistance are also possible. Shims are available in different thicknesses depending on the screw diameter.

Requirements:

- Division of the inner or outer construction.
- The height of the raceway bed is 0,3 to 0,5 mm smaller on the side of the split adjacent construction. This gap is required to accommodate the shims.
- The split side of the adjacent construction should be fixed using a centring collar. This is the only way to guarantee the concentricity of the two raceways.



Installation and adjustment:

Before installation, both the raceways and the wire bed must be cleaned. The races are inserted in the adjacent construction. In order to hold the races in position during fitting, the race beds can be coated with grease. The joints of the opposing race rings in the same part are each fitted at an angle of approx. 180°. The split side of the adjacent construction is then brought into the intended position.

Then insert the cage segments with the balls and grease the bearing element (see 6.1 Lubrication and maintenance). Before the adjacent construction of the split side is closed, the shims must be distributed over the screw holes of the retaining screws. The thickness depends on the designed gap (see above).

After the screws (see 6.5 Screw connections) have been tightened and the rotary joint has been turned through 360° approx. 2 to 3 times, check the rotational resistance. If the measured value deviates more than 5 to 10 %, the thickness of all shims must be changed and the procedure repeated.

#### 5.1.2 Adjustment by massive tuning

When using solid tuning, the tuning surface is brought to the required dimension by grinding over it. This method achieves the best accuracy since the interface between the split side of the adjacent construction is interlocking and no tension can build up.

Requirements:

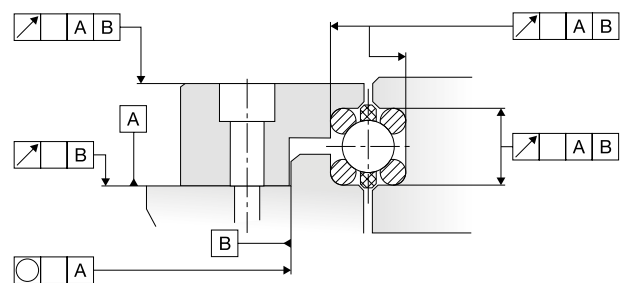
- Division of the inner or outer construction.
- Surface grinding machine of suitable size.
- The height of the raceway bed on the side of the split adjacent construction is 0.1 mm greater. This allowance is required for the adjustment.
- The split side of the adjacent construction should be fixed using a centring collar. This determines the concentricity of the two raceways.

Installation and adjustment:

The cage segments with the balls are inserted and the bearing assembly is sealed with the second split side of the adjacent construction (shim ring). After the screws have been tightened as specified (see 6.5 Screw connections) and the bearing assembly has been turned through 360° approx. 2 or 3 times, the clearance between the inner and outer ring is measured using a dial gauge. The tuning ring is then dismantled again and the measured value determined plus 0.02 to 0.03 mm is ground off with the surface grinding machine.

To ensure that this surface remains parallel to the raceway support, a suitable mounting surface must be provided at the design stage.

After the grinding dust has been thoroughly removed, the ring is remounted as described above and the bearing is moved. Then check the rotational resistance. If this measured value deviates more than 5 to 10 %, the procedure must be repeated. Finally the bearing assembly is greased via the lubrication holes provided (see 6.1



Lubrication and maintenance).

The bearings are suitable for continuous operation at temperatures between -10 °C and +70 °C - for short periods up to +120 °C.

Peripheral speeds of 10 m/s with grease lubrication and 12 m/s with oil lubrication can be achieved. The setting of the preload is an important prerequisite for a long service life of the bearing element. The preload ensures that all raceways are involved in load carrying and that the balls run optimally at their predetermined position. The preload is correctly adjusted when the rotational resistance without seal corresponds to the values in the diagram under point 6.

Note: It is advisable to adjust the preload, because even with optimum production there are tolerances which must be compensated.

## 5.2 Installation and adjustment of slim bearings

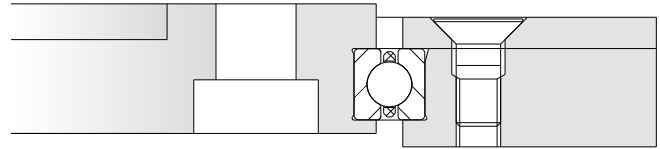
In the LSA, two running wires are combined into a single wire.

The special profile of the raceways maintains the 4-point principle. This makes installation just as easy as with conventional slim bearings.

The assembly is carried out in the following steps:

1. Clean components with a clean, lint-free cloth.
2. Grease the raceways (rear side).
3. Insert the race ring inner ring in the inner ring of the adjacent construction. Ensure that the raceway ends are separated by a gap.
4. Place the cage and outer race onto the inner race. Hold the raceway ends of the outer race together so that the ball cage cannot slip out.
5. Position the outer ring and push it in axially.
6. Replace the cover and screw it on.

Installation suggestion:



## 6 Installation and adjustment of bearing assemblies

Franke bearing assemblies are ready-to-install complete bearings. The specified or defined running accuracy, rotational resistance, rigidity and general characteristics depend both on the adjacent construction and on the correctness or completeness of the data transmitted. They must therefore be given particular attention.

### 6.1 Lubrication and maintenance

In order to keep friction low and to protect the bearing arrangement permanently against corrosion, sufficient lubrication should be ensured. All lubricants are subject to an ageing process that limits the operating life. The best resistance to ageing is achieved with fully synthetic lubricants. The grease SHELL GADUS S3 V 2200C for Franke bearing assemblies is used for initial greasing. The ageing resistance of this lubricant is approx. three years. This lubricant is also recommended for the use of bearing elements.

As an alternative, high-quality lithium soap greases based on synthetic oils or mineral oil or according to DIN 51825-K2 K-40. Questions regarding the lubricant, such as miscibility, aggressiveness, extreme temperatures, disposal, areas of application, etc. must be clarified with the respective manufacturer of the lubricant.

### 6.2 Initial lubrication and relubrication

The amount of lubricant required by a wire-race bearing for lubrication is relatively small and is self-adjusting depending on the speed. If the quantity of lubricant is too large, the rolling action will cause increased temperatures which will limit or suspend the lubricity. The service life of the bearing is considerably reduced by the increased wear. The lubricant quantity depends on the calculated clearance inside the bearing assembly. The calculated volume must be filled with 20 to 30 % lubricant. For swivel bearings, 30 to 40 % is recommended.

Franke bearing assemblies are ready-to-install complete bearings. Bearing elements and slim bearings are treated with corrosion protection oil for transport and must be greased during assembly.

### 6.3 Relubrication and lubrication intervals

The lubricity decreases as a result of mechanical stress and signs of ageing. It is therefore necessary to supplement the existing lubricant quantity or to renew it completely (e.g. in case of heavy contamination). The bearing must be rotated during relubrication. Relubrication should be carried out at below operating temperature if possible.

#### 6.3.2 Relubrication and lubrication intervals for bearing elements LV

The relubrication quantity is calculated as follows:

- $m$  =  $KK\varnothing \times H1 / 3 \times X$
- $H1$  = Bearing ring height in mm
- $KK\varnothing$  = Ball and cage diameter in mm
- $m$  = Relubrication quantity in g
- $X$  = Factor according to Table 1 in  $\text{mm}^{-1}$

Relubrication intervals:

An exact determination of the intervals is specific to the application and can therefore only be determined correctly by tests (for reference values see Table 1). To determine the factor  $X$  (Table 2), the time value read off is set in relation to the duty cycle of the application.

Note: For standard bearings, it is sufficient to fit a relubrication facility, since the lubricant is distributed evenly by the bearing movement. In the case of swivel bearings, at least three relubrication possibilities must be provided ( $3 \times 120^\circ$ ).

$V_u$ m/s	Intervall h
0 bis < 3	5000
3 bis < 5	1000
5 bis < 8	600
3 bis < 10	200

Table 1: Relubrication time limits

intervall	weekly	monthly	annually	2–3 years
$X$	0,002	0,003	0,004	0,005

Table 2: Relubrication intervals

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

Calculation example:

- Bearing assembly type LVA,  $KK\varnothing$  500 mm,
- Peripheral speed 3 m/s
- Duty cycle approx. 16 h/day
- Relubrication period for 3 m/s is 1000 h (see Table 1) =  $1000 \text{ (h)} / 16 \text{ (h/day)} = 63 \text{ days} \sim 3 \text{ months}$  for 16 h/day duty cycle

Relubrication should be carried out quarterly. Accordingly, the factor  $X$  (Table 2) is rounded and amounts to 0.003. Dimension  $H1$  is 42 mm (see [www.franke-gmbh.de](http://www.franke-gmbh.de)).

- $m = 500 \text{ mm} \times 42 / 3 \text{ mm}^{-1} \times 0.003 \text{ g} = 21 \text{ g}$
- The relubrication quantity is 21 g SHELL GADUS every three months. The shelf life of the lubricant is three years.

### 6.4 Lubrication and lubrication intervals for the gearing

Automatic gear lubrication is recommended. In the case of manual lubrication, the gear teeth and pinion must be adequately lubricated before commissioning. The lubrication interval depends on the design and the peripheral speed and must therefore be considered individually.

### 6.5 Screw connections

The number and diameter of the screws for mounting on the adjacent construction should always be checked. The distance  $X$  from retaining screw to retaining screw should not exceed 125 mm to avoid bridging. The fixing screws are tightened crosswise with a torque wrench in relation to the screw quality - according to the specifications in Table 3.

	Quality Nm	
	8.8	12.9
M 6	10	17
M 8	25	41
M10	49	83
M12	86	145
M16	210	355

Table 3: Tightening torques



To compensate for settlement effects, the screws must be retightened to the specified tightening torque. This procedure should be carried out if possible when the screws are free of additional forces.

The checks must be carried out after approximately 100 and then every 600 operating hours. For special operating conditions (e.g. due to strong vibrations) this period can be considerably shorter.

## 6.6 Gearing

As standard Franke supplies a straight gearing without hardening (material 42CrMo4V) and special gearing on request. The material, the design and the quality can also be changed on request.

## 6.7 Tolerances and accuracies

All tolerances and accuracies are stated on the respective catalogue pages. The greatest possible accuracies are achieved if the design of the enclosing parts is such that all diameters and surfaces in relation to each other can be machined in one clamping. The running accuracies in the catalogue are average values and can be further improved by limiting the tolerances. The tolerance specification T = IT6 or T = IT7 refers to the diameter-dependent basic tolerances according to DIN ISO 286.

Nominal dimension range mm starting from ... up to		Basic tolerances µm 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 specifications DIN ISO 286 T1 (11.90)

## 7 Rotary tables and direct drives

Franke rotary tables are highly resilient and particularly suitable for assembly, measuring and testing tasks. All rotary tables have a compact aluminum housing with integrated Franke components. A worm gear guarantees high accuracy even under continuous load. The rotary tables are extremely tilt resistant at a low tare weight.

Bearing assemblies with direct drive are suitable for applications where high performance and low space requirements are important criteria. The integration of the drive into the bearing housing means that wear-prone components for transmitting drive power such as toothed belts, shafts or chains are no longer needed. This reduces the required drive energy and also benefits more precise positioning.

### 7.1 Load capacity

The recommended safety for Franke turntables is  $Sst \geq 3$  for simple load ratios and  $Sst \geq 6$  for dynamically changing load and lever ratios. Franke will calculate the load and service life if required.

### 7.2 Temperature range

The rotary tables can be operated at an operating temperature of  $-10\text{ °C}$  to  $+80\text{ °C}$ . Extended temperature ranges are possible on request.

### 7.3 Lubrication

In general, all standard rotary tables are provided ex works with long-term lubrication with the wire-race bearing grease ISOFLEX TOPAS NCA52. It is recommended to relubricate Franke rotary tables - depending on the application - every six months to annually.

Lubrication point	Lubrication quantity g		
	left	front	right
LTA100		1	1
LTA200		1	1
LTB125	2		
LTB175		3	
LTB265		3	
LTB400		4	
LTD100			
LTD205			
LTD320			
LTD385			

## 7.4 Options

- One or two integrated inductive proximity switches
- Freely positionable trip cams
- Mounting kits for motors according to customer requirements
- Motorization depending on the application with stepper or servo motors
- Encoder mounting on the second shaft end of the worm shaft
- Complete automation solutions

**For all technical information, please also refer to our assembly and maintenance instructions for the respective products.**



Technical Information on Wire Race Bearings  
We reserve the right for errors and alterations.

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