High precision bearings for combined loads

EVOLMEC®
EVOLUZIONE MECCANICA

ROGALLA
WÄLZLAGER • DREHVERBINDUNGEN

EVOLMEC ® S.r.l.

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Axial/radial bearings

Features

Axial/radial bearings **EVRT** and **EVRTS** and axial angular contact ball bearings **EVLDF** are ready-to-fit high precision bearings for high precision applications with combined loads.

They can support radial loads, axial loads from both sides and tilting moments without clearance and are particularly suitable for bearing arrangements with high requirements for running accuracy.

Due to the fixing holes in the bearing rings, the units are very easy to fit. The bearings are radially and axially preloaded after fitting.

The mounting dimensions of all series are identical.

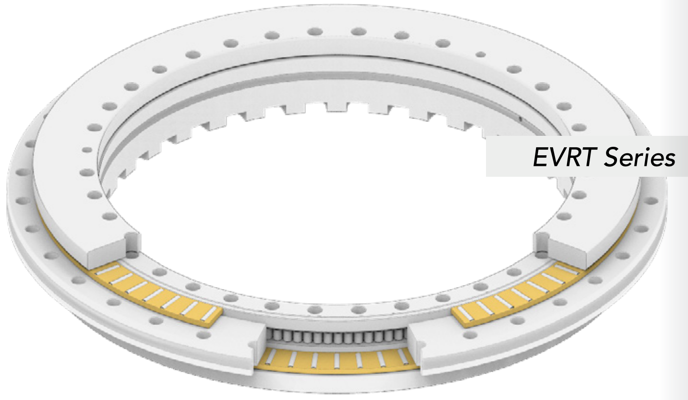
Areas of application

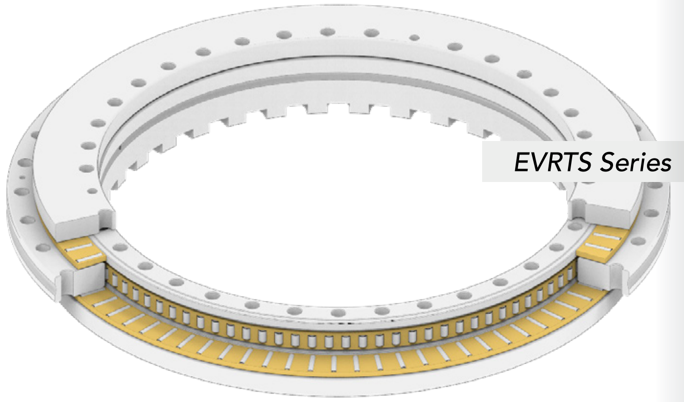
For standard applications with low speeds and small operating durations, such as indexing tables and swivel type milling heads, the most suitable bearing is generally series **EVRT**.

For the bearing arrangements of direct drive axes, there is the series **EVRTS**. Due to their high limiting speeds and very low, uniform frictional torque across the whole speed range, these bearings are particularly suitable for combination with torque motors.

For higher accuracy requirements, these bearings are also available with restricted axial and radial runout accuracy.

Axial angular contact ball bearings **EVLDF** are particularly suitable for high speed applications with long operating duration. They are characterised by high tilting rigidity, low friction and low lubricant consumption.





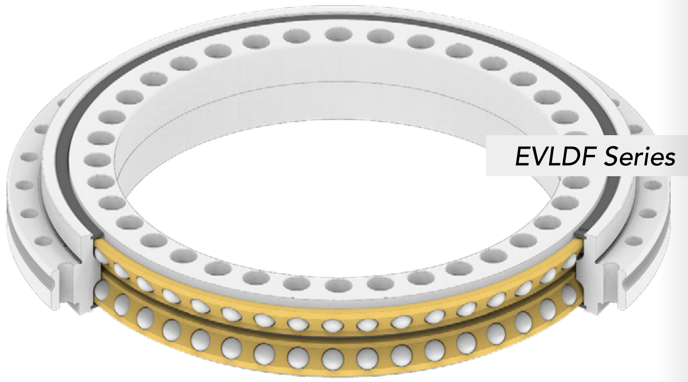
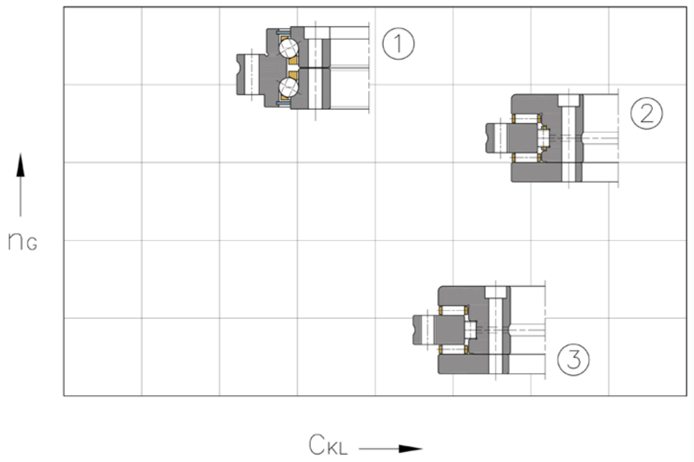


Figure 1
Speed and tilting rigidity

n_g = Limiting speed
C_{KL} = Tilting rigidity
① EVLDF
② EVRTS
③ EVRT



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Axial/radial bearings

Axial/radial bearings **EVRT** and **EVRTS** have an axial component and a radial component.

The axial component comprises an axial needle roller or cylindrical roller and cage assembly, an outer ring, L-section ring and shaft locating washer and is axially preloaded after fitting.

The radial component is a full complement cylindrical roller set in **EVRT** and a cage-guided, preloaded cylindrical roller set in **EVRTS**. The outer ring, L-section ring and shaft locating washer have fixing holes.

The unit is located by means of retaining screws for transport and safe handling.

Sealing

Axial/radial bearings are supplied without seals.

Lubrication

The bearings are provided with SHELL grease. The bearings can be lubricated via the outer ring and L-section ring.

Operating temperature

EVRT and **EVRTS** axial/radial bearings are suitable for use at temperatures between -30°C and +120 °C.

Axial angular contact ball bearings

Axial angular contact ball bearings **EVLDF** comprise a single-piece outer ring, a two-piece inner ring and two ball and cage assemblies with a contact angle of 60°. The outer ring and inner ring have fixing holes for screw mounting of the bearing on the adjacent construction.

The unit is located by means of retaining screws for transport and safe handling.

Sealing

Axial angular contact ball bearings have sealing shields on both sides.

Lubrication

The bearings are provided with SHELL grease. The bearings can be relubricated via the outer ring.

Operating temperature

EVLDF axial angular contact ball bearings are suitable for use at temperatures between -30°C and +120 °C.

Suffixes for available designs

Suffixes	Description	Design
H1...	For EVRT, closer tolerance on mounting dimension H1 (For restricted tolerance value, see table, page 18)	Special design, available by agreement only
H2...	For EVRT, closer tolerance on mounting dimension H2 (For restricted tolerance value, see table, page 18)	
RT	For EVRT, axial and radial runout tolerance restricted by 50% (For restricted tolerance value, see table, page 19) For EVRTS, axial and radial runout tolerance of the rotating inner ring restricted by 50% (For restricted tolerance value, see table, page 19)	
VSP	For mounting with an axially supported L-section ring in series EVRT, see pages from 20 to 23, for EVRTS, see pages 24 and 25	

Basic rating life

The load carrying capacity and life must be checked for the radial and axial bearing component.

Please contact our technical department in order to check the basic rating life. The speed, load and operating duration must be given.

Static load safety factor

The static load safety factor f_0 indicates the security against impermissible permanent deformations in the bearing:

$$f_0 = \frac{C_{0r}}{F_{0r}} \text{ or } \frac{C_{0a}}{F_{0a}}$$

f_0 - Static load safety factor

C_{0r}, C_{0a} - Basic static load rating according to dimension tables

F_{0r}, F_{0a} - Maximum static load on the radial or axial bearing.

In machine tools and similar areas of application, f_0 should be > 4.

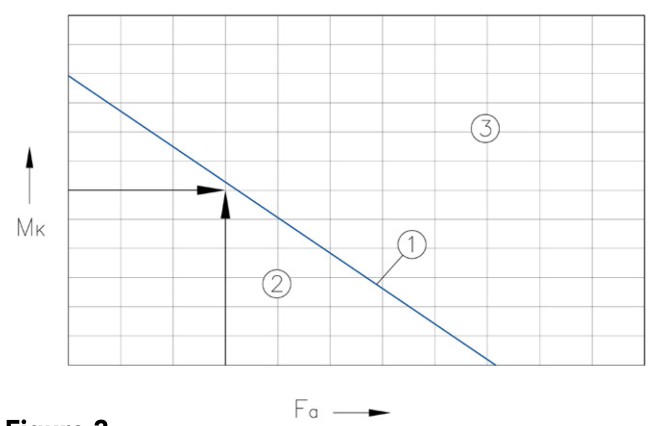


Figure 2

Static limiting load diagram (example)

M_k = Maximum tilting moment

F_a = Axial load

① Bearing, size

② Permissible range

③ Impermissible range

Static limiting load diagrams

The static limiting load diagrams can be used:

- For rapid checking of the selected bearing size under predominantly static load
- For calculation of the tilting moment M_k that can be supported by the bearing in addition to the axial load.

The limiting load diagrams are based on a rolling element set with a static load safety factor $f_0 \geq 4$, as well as the screw and bearing ring strenght.

The static limiting load must not be exceeded when choosing the bearings (Figure 2 to Figure 9)

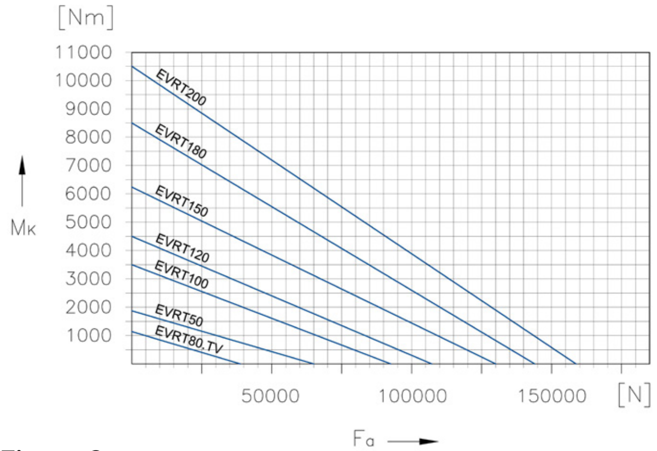


Figure 3

Static limiting load diagram for EVRT 50 to EVRT 200

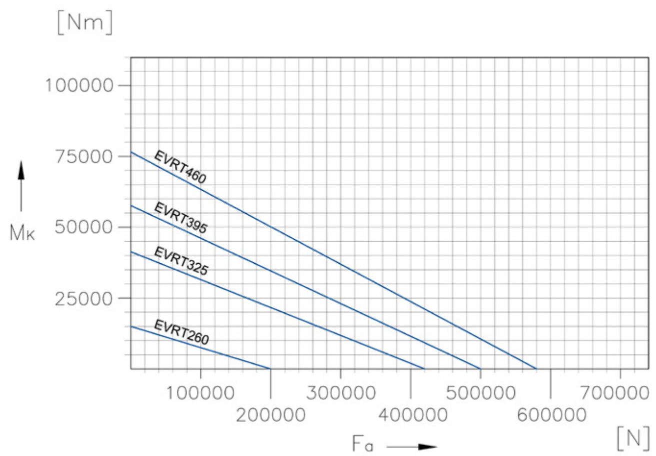


Figure 4

Static limiting load diagram for EVRT 260 to EVRT 460

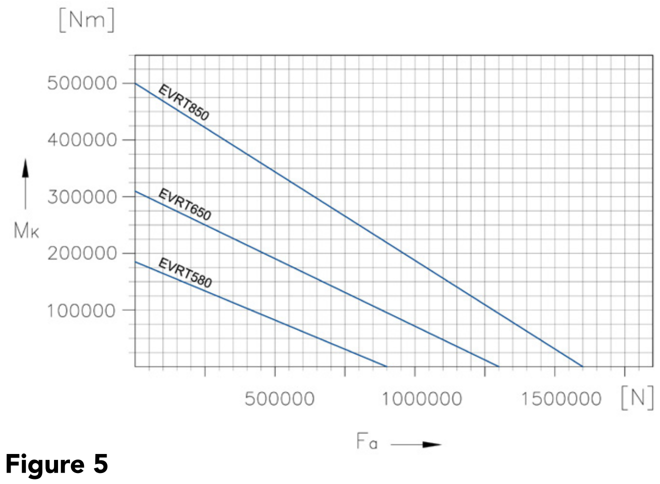


Figure 5

Static limiting load diagram for EVRT 580 to EVRT 850

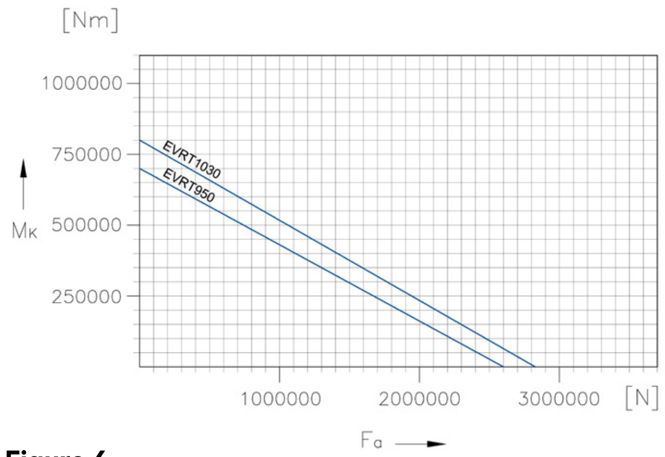


Figure 6

Static limiting load diagram for EVRT 950 to EVRT 1030

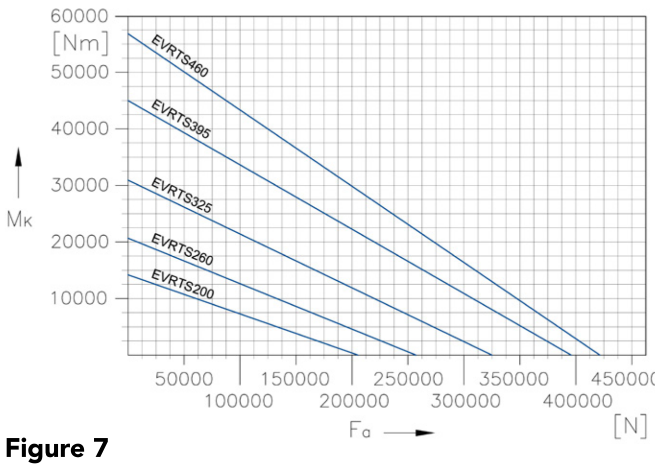


Figure 7

Static limiting load diagram for EVRTS 200 to EVRTS 460

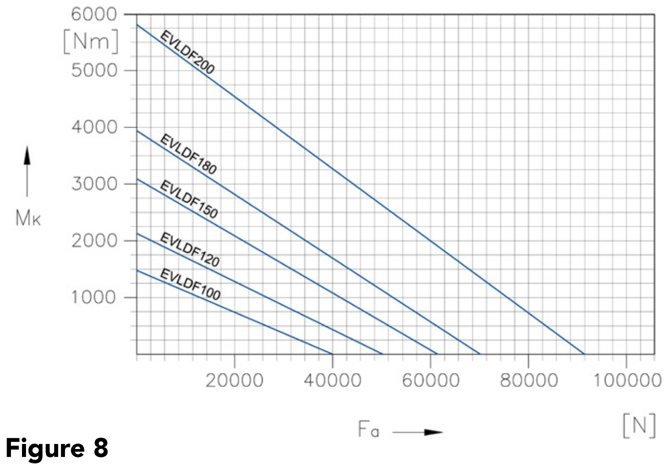


Figure 8

Static limiting load diagram for EVLDF 100 to EVLDF 200

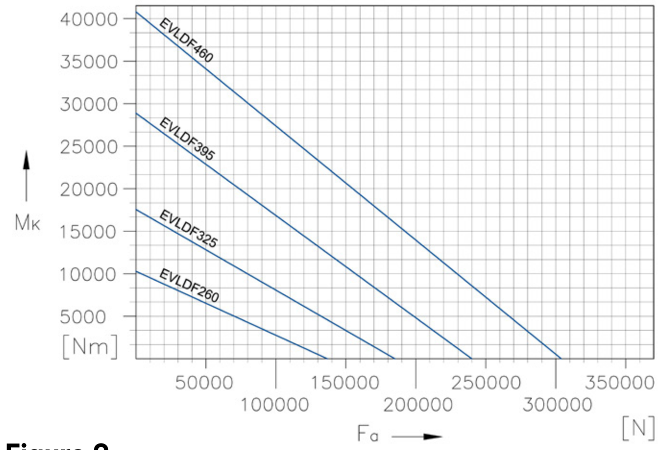


Figure 9

Static limiting load diagram for EVLDF 260 to EVLDF 460

M_k = Maximum tilting moment

F_a = Axial load

Limiting speeds

In bearing selection, the following guidelines and the limiting speeds must be observed, see dimension tables.

If the environmental conditions differ from the specifications in relation to adjacent construction tolerances, lubrication, ambient temperature, heat dissipation or from the normal operating conditions for machine tools, the stated limiting speeds must be checked. Please contact us.

Axial/radial bearings EVRT

Axial/radial bearings EVRT are designed, by means of the full complement radial roller bearing component for high rigidity, for rapid positioning and operating at low speed. Low speeds are normally required for multiple-axis simultaneous machining.

The limit value n_G stated in the dimension tables relates to the maximum swivel speed and a maximum speed applied for a short period. In aplication with a high operating duration ED or continuous operation at a speed of more than n x d = 35.000 min^{-1} x mm at an ED>10%, the series EVRTS or EVLDF should be selected.

Axial/radial bearings EVRTS and axial angular contact ball bearings EVLDF

The limiting speeds n_G stated for these two bearing series were determined on test rigs.

During the test, the following conditions apply:

- Grease distribution cycle according to the defined data, see Figure 14 at page 11
- Maximum increase in bearing temperature of 40 °C in the area of the raceway.
- Operating duration ED = 100%, which means continuous operation at the limiting speed n_G.
- Bearing fully screw mounted on solid fixtures.
- No external load, only preload and mass of the fixtures.

Temperature distribution in the rotary axis system

Rotary axes with a main spindle function, such as those used for combined milling and turning and with direct drive by a torque motor, are systems with complex thermal characteristics. The temperature distribution in the rotary axis system must be considered in greater detail during the design process:

- Asymmetrical rotary axis housings can undergo asymmetrical deformation due to heating.
- In turn, out-of-round bearing seats lead to additional bearing load, reduced life and a negative influence on running behaviour and running accuracy.
- Temperature management of the rotary axis in the form of targeted cooling and heating is generally necessary for high performance rotary axes.

Axial/radial bearings - Axial angular contact ball bearings
Technical features

Design regulations

Proven design regulations based on practical experiences, Figure 10:

- The contact face between the stator of the torque motor and the rotary table housing should be as small as possible, in order to minimise the flow of heat between stator and rotary table housing.
- Where possible, do not connect the casing of the stator cooling system to the rotary table housing.
- Preferably, mount the rotary table to the rotor of the torque motor using a flange rather than directly mounting it on the bearing, to keep the flow of heat through the bearing to a minimum.
- The distance between the motor and the bearing should be as large as possible. A large distance reduces the transfer of heat from the rotor to the bearing. The stresses occurring between the components as a result of varying thermal expansion are reduced by the increased elasticity of the system.
- The rotary table plate bearing must be centered with sufficient rigidity to allow the overall system to attain a high level of rigidity. The risk of deformation to the bearing seat due to the increase in the temperature of the rotor is also reduced.

Regulated cooling of the stationary and rotating components may be required in order to limit the temperature variations between the bearing inner and outer ring.

Bearing preload

Once the bearings have been fitted and fully screw mounted, they are radially and axially clearance-free and preloaded.

Temperature differences

Temperature differences between the shaft and housing influence the radial bearing preload and thus the operating life of the bearing arrangement.

If the shaft temperature is higher than the housing temperature, the radial preload will increase proportionally, so there will be an increase in the rolling element load, bearing friction and bearing temperature, while the operating life will be reduced.

If the shaft temperature is lower than the housing temperature, the radial preload will decrease proportionally, so the rigidity will decrease to bearing clearance. There will be an increase in wear, the operating life will be reduced and noise due to slippage may occur.

Figure 10
Ideal rotary table, taking account of the occurring heat

Q = Heat flow

X = Distance from torque motor to bearing

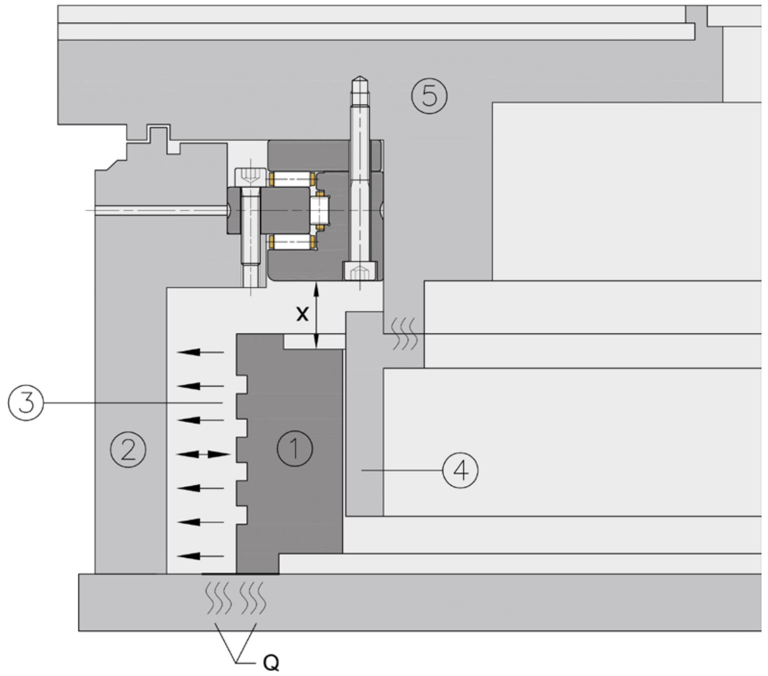
① Stator of the torque motor

② Rotary table housing

③ Stator cooling

④ Rotor of the torque motor

⑤ Rotary table plate



Frictional torque

The bearing frictional torque M_{RL} is influenced primarily by the viscosity and quantity of the lubricant and the bearing preload:

- The lubricant viscosity is dependent on the lubricant grade and operating temperature.
- When relubrication is carried out, the lubricant quantity is increased for a short time until the grease is distributed and the excess quantity has left the bearing.
- During initial operation and after relubrication, bearing friction is increased until the lubricant has been distributed within the bearing.
- The bearing preload is dependent on the mounting fits, the geometrical accuracy of the adjacent parts, the temperature difference between the inner and outer ring, the screw tightening torque and mounting situation (bearing inner ring axially supported on one or both sides).

Guide values for frictional torque M_R

The stated frictional torques M_R are statistically determined guide values for bearings with grease lubrication after a grease distribution cycle (**Figure 14 - page 11**). **Figure 11** shows measured frictional torque for mounting with an unsupported L-section ring.

In the mounting variant with an L-section ring supported over its whole surface, these values are increased as a function of the washer thickness and the geometrical accuracy of the supporting ring by an average of 10% to 20%. The guide values for the frictional torque for axial/radial bearings **EVRT** were determined at a measurement speed **n** = 5 min^{-1}, see dimension table.

Deviations from the tightening torque of the fixing screws will have a detrimental effect on the preload and the frictional torque. For **EVRT** bearings, it must be taken into consideration that the frictional torque can increase by a factor 2 to 2,5 with increasing speed.

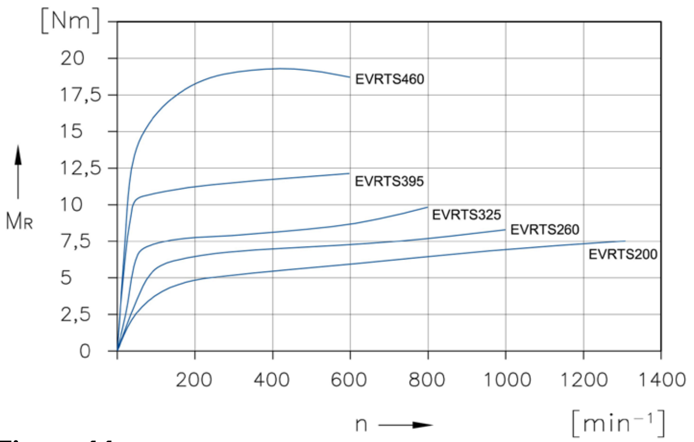


Figure 11

Frictional torque as guide values for EVRTS, statistically determined values from series of measurements

M_R = Frictional torque

n = Speed

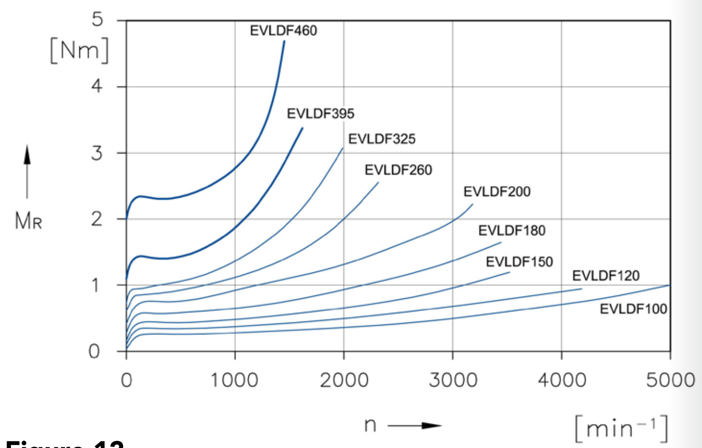


Figure 12

Frictional torque as guide values for EVLDF, statistically determined values from series of measurements

M_R = Frictional torque

n = Speed

Axial/radial bearings - Axial angular contact ball bearings
Technical features

Relubrication and initial operations

The speed capability, friction, rating life, functional capability and the durations of relubrication intervals are essentially influenced by the grease used, see table.

Axial/radial bearings **EVRT** and **EVRTS** can be relubricated via a lubrication groove in the L-section ring and the outer ring.

Axial angular contact ball bearings **EVLDF** can be relubricated via a lubrication groove in the outer ring.

For calculation of the relubrication quantities and intervals based on a stated load spectrum (speed, load, operating duration) and the environmental conditions, please contact us.

Relubrication

Series	Grease type
EVRT	Shell Gadus S5 V100 2
EVRTS	Shell Gadus S3 V220C 2
EVLDF	Shell Gadus S5 V100 2

Initial operations

Rolling bearings may exhibit increased frictional torque during initial operation, which can lead to overheating in the high speed series **EVRTS** and **EVLDF** where there is immediate operation at high speeds.

In order to prevent overheating of the bearing, the running-in cycle must always be carried out, **Figure 14**. The cycle may be shortened if there is appropriate monitoring of the bearing temperature.

The bearing ring temperature must not exceed 60 °C.

Overlubrication

The two high speed bearing series **EVRTS** and **EVLDF** may be damaged by overheating as a result of increased frictional torque when operating at high speeds if they have been accidently overlubricated.

In order to achieve the original frictional torque again, the running-in cycle in accordance with **Figure 14** should be carried out.

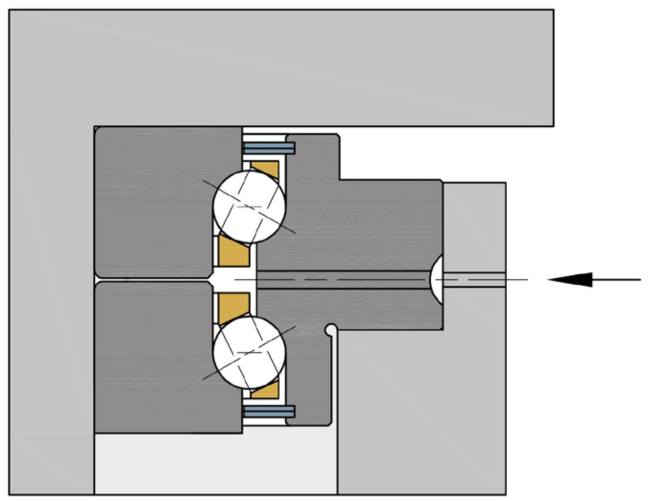


Figure 13

Relubrication via the lubrication groove in the outer ring

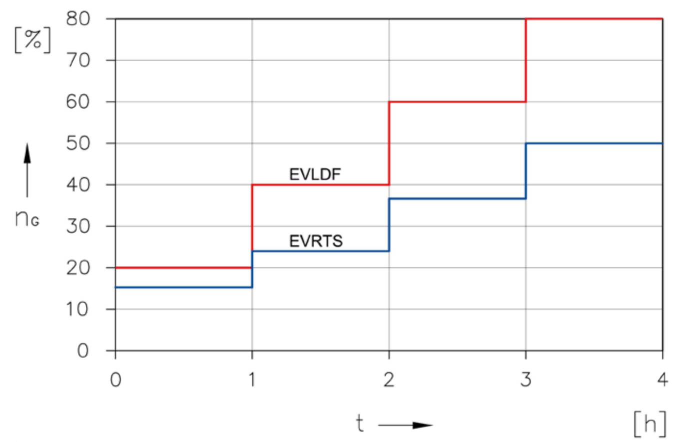


Figure 14

Running-in cycle for initial operation and after overlubrication

n_G = Limiting speed accoding to dimension tables

t = Time

Design of adjacent construction

Geometrical defects in the screw mounting surfaces and fits will influence the running accuracy, preload and running characteristics of the bearing arrangement. The accuracy of the adjacent surfaces must therefore be matched to the overall accuracy requirement of the subassembly. The tolerances of the adjacent surfaces must lie within the running tolerance of the bearing.

The adjacent construction should be produced in accordance with Figure 15 and the tolerances must be in accordance with the relative tables (pages 14 and 15). Any deviations will influence the bearing frictional torque, running accuracy and running characteristics.

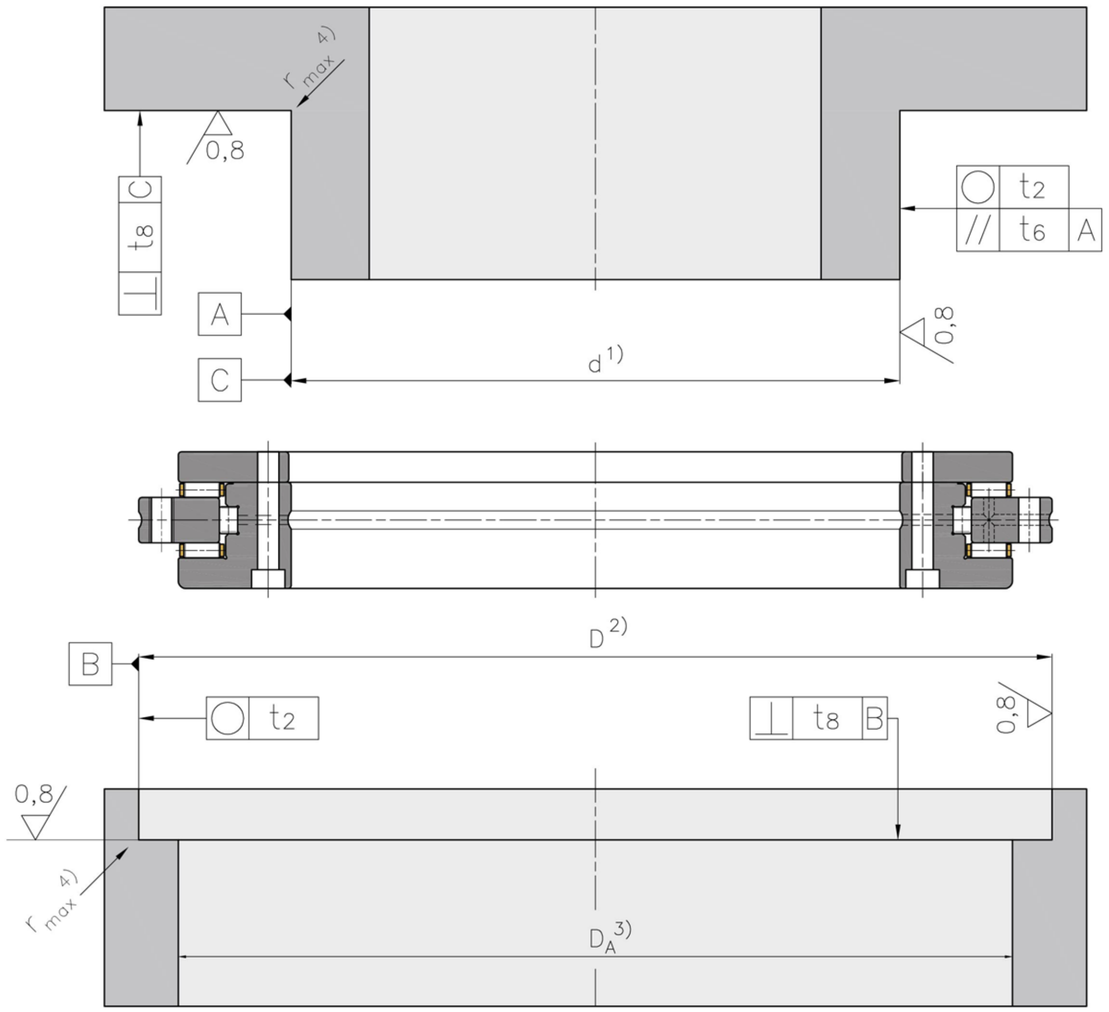


Figure 15

Requirements for the adjacent construction (EVRT, EVRTS, EVLDF)

1) *Tolerance class: see tables, pages 14 and 15. Support over whole bearing height. It must be ensured that the means of support has adequate rigidity.*

2) *Tolerance class: see tables, pages 14 and 15. A precise fit is only necessary if radial support due to the load or a precise bearing position is required.*

3) *Note the bearing diameter D1 in the dimension tables. Ensure that there is sufficient distance between the rotating bearing rings and the adjacent construction.*

4) *Values, see table Maximum corner radii of fit surfaces for EVRT, EVRTS and EVLDF (from page 15).*

Fits

The selection of fits leads to transition fits, i.e. depending on the actual dimensional position of the bearing diameter and mounting dimensions, clearance fits or interference fits can arise.

The fit influences, for example, the running accuracy of the bearing and its dynamic characteristics. An excessively tight fit will increase the radial bearing preload.

As a result:

• There is an increase in bearing friction and heat generation in the bearing as well as the load on the raceway system and wear.

• there will be a decrease in the achievable speed and the bearing operating life.

For easier matching of the adjacent construction to the actual bearing dimensions, each bearing of series **EVRT** and **EVRTS** is supplied with a measurement record (this is available by agreement for other series).

Axial and radial runout accuracy of the bearing arrangement

The axial and radial runout accuracy is influenced by:

- The running accuracy of the bearing
- The geometrical accuracy of the adjacent surfaces
- The fit between the rotating bearing ring and adjacent component.

For very high running accuracy, the rotating bearing ring should ideally have a fit clearance 0 and it should be ensured that the bearing has preload in operation (see page 9).

Recommended fits for shafts

The shaft should be produced to tolerance zone **h5** and for series **EVRTS**, in accordance with table, page 15. If there are special requirements, the fit clearance must be further restricted within the stated tolerance zones:

Requirements for running accuracy:

Where maximum running accuracy is required and the bearing inner ring is rotating, the aim should be to achieve as close as possible to a fit clearance 0. The fit clearance may otherwise increase the bearing radial runout. With normal requirements for running accuracy or a stationary bearing inner ring, the shaft for axial/radial bearings **EVRT** and **EVLDF** should be produced to **h5**.

For axial/radial bearing **EVRTS**, the recommended fits for shaft and housing bore must be observed

Requirements for dynamic characteristics:

- For swivel operation (**n x d** < 35.000 min^{-1} x mm, operating duration **ED** < 10%) the shaft should be produced to **h5**. The tolerance field **h5** can be used under these operating conditions for axial/radial bearings **EVRT**, **EVLDF** e **EVRTS**.
- For higher speeds and longer operating duration, the fit interference must not exceed 0,01 mm. For series **EVRTS**, the fit interference must not exceed 0,005 mm.

For series **EVLDF**, the fit clearance should be based on the inner ring with the smallest bore dimension.

Recommended fits for housings

The housing should be produced to tolerance zone **J6** and for series **EVRTS** in accordance with table at page 15. If there are special requirements, the fit clearance must be further restricted within the stated tolerance zones:

Requirements for running accuracy:

For maximum running accuracy and with a rotating bearing outer ring, the aim should be to achieve as close as possible to a fit clearance of 0.

With a static bearing outer ring, a clearance fit or a design without radial centring should be selected.

Requirements for dynamic characteristics:

- For predominantly swivel type operation (**n x d** < 35.000 min^{-1} x mm, operating duration **ED** < 10%) be produced to tolerance zone **J6**. The tolerance field **J6** can be used under these operating conditions for axial/radial bearings **EVRT**, **EVLDF** and **EVRTS**.
- For axial/radial bearing **EVRTS** with a higher speed and operating duration, the bearing outer ring should not be radially centred or the housing fit should be produced as a clearance fit with at least 0,02 mm clearance. This will reduce the increase in preload that occurs where there is a temperature differential between the inner ring and outer ring of the bearing.

Fit selection depending on the screw connection of the bearing rings

If the bearing outer ring is screw mounted on the static component, a fit seating is not required or a fit seating can be produced as stated, see tables, **pages 14** and **15**. If the values in the table are used, this will give a transition fit with a tendency towards clearance fit.

This generally allows easy fitting. If the bearing inner ring is screw mounted on the static component, it should nevertheless for functional reasons be supported by the shaft over the whole bearing height. The shaft dimensions should then be selected accordingly, see tables, **pages 14** and **15**. If these values in the table are used, this will give a transition fit with a tendency towards clearance fit.

Geometrical and positional accuracy of the adjacent construction

The values given in the following tables for geometrical and positional accuracy of the adjacent construction have proved effective in practice and are adequate for the majority of applications.

The geometrical tolerances influence the axial and radial runout accuracy of the subassembly as well as the bearing frictional torque and the running characteristics.

EVRT - EVLDF

Diameter and geometrical tolerances for shafts

d		Deviation Tolerance class h5		Roundness Tolerance t_2	Parallelism Tolerance t_6	Perpendicularity Tolerance t_8
>	≤	U	L	max	max	max
mm		µm		µm	µm	µm
50	80	0	-13	3	1,5	3
80	120	0	-15	4	2	4
120	180	0	-18	5	2,5	5
180	250	0	-20	7	3,5	7
250	315	0	-23	8	4	8
315	400	0	-25	9	4,5	9
400	500	0	-27	10	5	10
500	630	0	-32	11	5,5	11
630	800	0	-36	13	6,5	13
800	1.000	0	-40	15	7,5	15
1.000	1.250	0	-47	18	9	18

EVRT, EVLDF

Diameter and geometrical tolerances for shafts

EVRT - EVLDF

Diameter and geometrical tolerances for housings

D		Deviation Tolerance class J6		Roundness Tolerance t_2	Perpendicularity Tolerance t_8
>	≤	U	L	max	max
mm		µm		µm	µm
120	180	+18	-7	5	5
180	250	+22	-7	7	7
250	315	+25	-7	8	8
315	400	+29	-7	9	9
400	500	+33	-7	10	10
500	630	+34	-10	11	11
630	800	+38	-12	13	13
800	1.000	+44	-12	15	15
1.000	1.250	+52	-14	18	18

EVRT, EVLDF

Diameter and geometrical tolerances for housings

EVRTS

Recommended fits for shaft and housing bore

Bearing	d Shaft diameter	Deviation Tolerance Shaft diameter		D Housing bore	Deviation Tolerance Housing bore	
		U	L		U	L
-	mm	µm		mm	µm	
EVRTS 200	200	-10	-24	300	+11	-5
EVRTS 260	260	-13	-29	385	+13	-5
EVRTS 325	325	-18	-36	450	+15	-5
EVRTS 395	395	-18	-36	525	+17	-5
EVRTS 460	460	-18	-38	600	+17	-5

EVRTS

Recommended fits for shaft and housing bore

EVRTS

Geometrical and positional accuracy for shafts

Bearing	Roundness Tolerance t_2 max	Parallelism Tolerance t_6 max	Perpendicularity Tolerance t_8 max
-	µm	µm	µm
EVRTS 200	6	2,5	5
EVRTS 260 to EVRTS 460	8	2,5	7

EVRTS

Geometrical and positional accuracy for shafts

EVRTS

Geometrical and positional accuracy for housings

Bearing	Roundness Tolerance t_2 max	Perpendicularity Tolerance t_8 max
-	µm	µm
EVRTS 200 to EVRTS 460	6	8

EVRTS

Geometrical and positional accuracy for housings

EVRT - EVRTS - EVLDF

Maximum corner radii of fit surfaces

d Bore diameter		Maximum corner radius R_{max}
>	≤	max
mm		mm
50	150	0,1
150	460	0,3
460	950	1

EVRT, EVRTS, EVLDF

Maximum corner radii of fit surfaces

Axial/radial bearings - Axial angular contact ball bearings
Technical features

Mounting dimensions H_1 and H_2

If the height variation must be as small as possible, the H_1 dimensional tolerance must conform to the tables, **pages 18** and **19**, and **Figure 16**.

The mounting dimension H_2 defines the position of any worm wheel used, **Figure 16** and **Figure** 17 L-section ring with support ring.

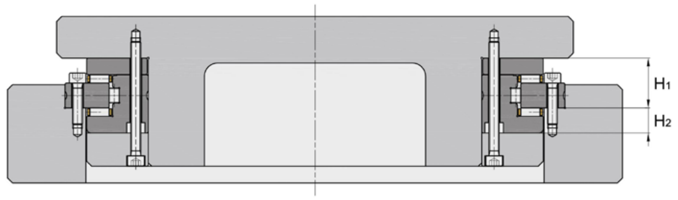


Figure 16

Mounting dimensions H_1, H_2

L-section ring without support ring or with support ring

The L-section ring of bearings **EVRT**, **EVRTS** and **EVLDF** can be mounted unsupported or supported over its whole surface as an inner ring, **Figure 17**.

The support ring (for example a worm wheel or torque motor) is not included in the scope of delivery.

For series **EVRTS** and **EVLDF**, there is only one preload match.

The increase in rigidity and frictional torque in **EVRTS** bearings is slight and can normally be ignored.

In bearings of series **EVLDF,** the rigidity and frictional torque are not influenced by the support ring.

In fitting of the series **EVRT** with an L-section ring supported axially over its whole surface, there is an increase in the axial rigidity in the direction of the support ring as a function of the support ring rigidity and in the tilting rigidity of up to 20%. In this case, delivery with a different preload match is necessary, suffix **VSP**.

If the normal design of series **EVRT** (without suffix **VSP**) is mounted with a supported L-section ring, there will be a considerable increase in the bearing frictional torque.

The shaft locating washer must be supported axially over its whole surface by the adjacent construction.

In the case of **EVRT...VSP**, the L-section ring must also be axially supported over its whole surface in order to achieve the stated rigidity values.

L-section ring without support ring

In the case of "L-section ring without support ring", the bearing designation is: **EVRT <bore diameter>**

L-section ring with support ring

For the case "L-section ring with support ring", the bearing designation is: **EVRT <bore diameter>.VSP**

In the case of series **EVRT**, the height of the support ring should be at least as large as the dimension H2 of the bearing.

Any mounting conditions that deviate from our suggestions, **Figure 17**, may impair the function and the performance data of the bearings. For different designs, please contact us.

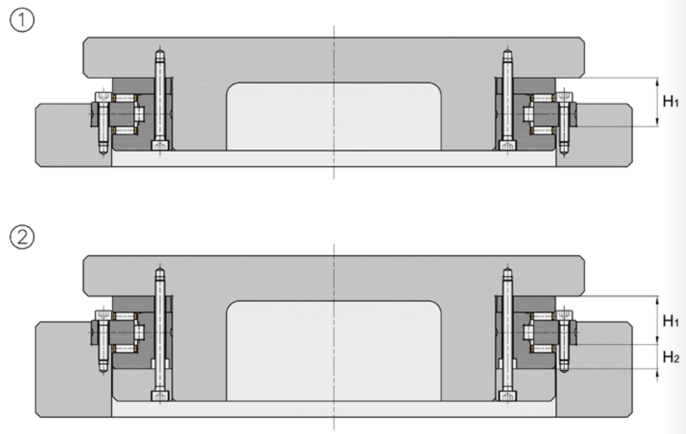


Figure 17

Mounting variants

① *EVRT - Unsupported L-section ring*

② *EVRT...VSP - Supported L-section ring*

Fitting

Retaining screws secure the bearing components during transport. For easier centring of the bearing, the screws should be loosened before fitting and either secured again or removed after fitting.

Tighten the fixing screws in a crosswise sequence using a torque wrench in three stages to the specified tightening torque M_A, while rotating the bearing **EVLDF**, **Figure 18**.

- Stage 1   40% of M_A
- Stage 2   70% of M_A
- Stage 3 100% of M_A

Observe the correct grade of the fixing screws.

Mounting forces must only be applied to the bearing ring to be fitted, never through the rolling elements.

Bearing components must not be separated or interchanged during fitting and dismantling.

If the bearing is unusually difficult to move, loosen the fixing screws and tighten them again in steps in a crosswise sequence.

This will eliminate any distortion.

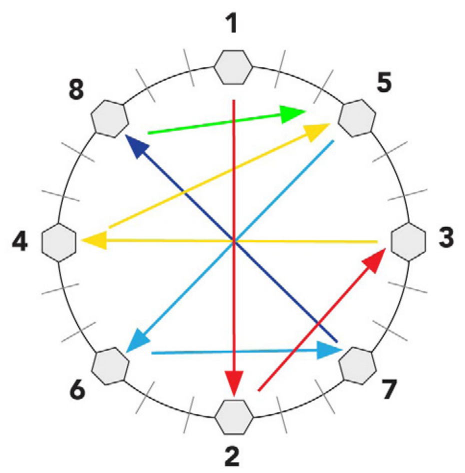


Figure 18

Tightening of fixing screws

Static rigidity

The overall rigidity of a bearing position is a description of the magnitude of the displacement of the rotational axis from its ideal position under load. The static rigidity thus has a direct influence on the accuracy of the machining results. The dimension tabls give the rigidity values for the complete bearing position. These take account of the deflection of the rolling element set as well as the deformation of the bearing rings and the screw connections.

The values for the rolling element sets are calculated rigidity values and are for information purposes only.

They facilitate comparison with other bearing types, since rolling bearing catalogues generally only give the higher rigidity values for the rolling element set.

Accuracy

The dimensional tolerances are derived from tolerance class P5.

The diameter tolerances stated are mean values in accordance with DIN 620.

The geometrical tolerances correspond to P4 in accordance with DIN 620, see table.

The bearing bore in series EVRT and EVRTS may be slightly conical in the delivered condition.

This is typical of the bearing design and is a result of the radial bearing preload forces. The bearing will regain its ideal geometry when fitted.

EVRT

Dimensional tolerances and mounting dimensions

EVRT
Dimensional tolerances and mounting dimensions

Dimensional tolerances 1)				Mounting dimensions					
Bore		Outer diameter		Normal		Restricted 2)	Normal		Restricted 2)
d	Δ_{ds}	D	Δ_{Ds}	H_1	Δ_{H1s}	Δ_{H1s}	H_2	Δ_{H2s}	Δ_{H2s}
mm		mm		mm		mm	mm		mm
50	-0,008	126	-0,011	20	±0,025	-	10	±0,020	-
80	-0,009	146	-0,011	23,35	±0,025	-	11,65	±0,020	-
100	-0,010	185	-0,015	25	±0,025	-	13	±0,020	-
120	-0,010	210	-0,015	26	±0,025	-	14	±0,020	-
150	-0,013	240	-0,015	26	±0,030	-	14	±0,020	-
180	-0,013	280	-0,018	29	±0,030	-	14	±0,025	-
200	-0,015	300	-0,018	30	±0,030	-	15	±0,025	-
260	-0,018	385	-0,020	36,5	±0,040	-	18,5	±0,025	-
325	-0,023	450	-0,023	40	±0,050	-	20	±0,025	-
395	-0,023	525	-0,028	42,5	±0,050	-	22,5	±0,025	-
460	-0,023	600	-0,028	46	±0,060	-	24	±0,030	-
580	-0,025	750	-0,035	60	±0,250	±0,075	30	±0,250	±0,300
650	-0,038	870	-0,050	78	±0,250	±0,100	44	±0,250	±0,300
850	-0,050	1095	-0,063	80,5	±0,300	±0,120	43,5	±0,300	±0,300
950	-0,050	1200	-0,063	86	±0,300	±0,120	46	±0,300	±0,300
1030	-0,063	1300	-0,080	92,5	±0,300	±0,150	52,5	±0,300	±0,300

1) *The diameter tolerances stated are mean values (DIN 620)*

2) *Special design with suffix H1 or H2, see table, page 5*

EVRTS

Dimensional tolerances and mounting dimensions

EVRTS
Dimensional tolerances and mounting dimensions

Dimensional tolerances 1)				Mounting dimensions		
Bore		Outer diameter				
d	Δ_{ds}	D	Δ_{Ds}	H_1	Δ_{H1s}	H_2
mm		mm		mm		mm
200	-0,015	300	-0,018	30	+0,04 / -0,06	15
260	-0,018	385	-0,020	36,5	+0,05 / -0,07	18,5
325	-0,023	450	-0,023	40	+0,06 / -0,07	20
395	-0,023	525	-0,028	42,5	+0,06 / -0,07	22,5
460	-0,023	600	-0,028	46	+0,07 / -0,08	24

1) *The diameter tolerances stated are mean values (DIN 620)*

EVOLMEC®

EVLDF

Dimensional tolerances and mounting dimensions

EVLDF
Dimensional tolerances and mounting dimensions

Dimensional tolerances 1)				Mounting dimensions	
Bore		Outer diameter			
d	Δ_{ds}	D	Δ_{Ds}	H_1	Δ_{H1s}
mm		mm		mm	
100	-0,010	185	-0,015	25	±0,175
120	-0,010	210	-0,015	26	±0,175
150	-0,013	240	-0,015	26	±0,175
180	-0,013	280	-0,018	29	±0,175
200	-0,015	300	-0,018	30	±0,175
260	-0,018	385	-0,020	36,5	±0,200
325	-0,023	450	-0,023	40	±0,200
395	-0,023	525	-0,028	42,5	±0,200
460	-0,023	600	-0,028	46	±0,225

1) *The diameter tolerances stated are mean values (DIN 620)*

EVRT, EVRTS, EVLDF

Axial and radial runout

EVRT - EVRTS - EVLDF
Axial and radial runout 1)

Bore	EVRT		EVRTS		EVLDF
	Normal 2)	Restricted 2)	Normal 2)	Restricted 3)	Normal 2)
d	t_1	t_1	t_1	t_1	t_1
mm	µm	µm	µm	µm	µm
50	2	1	-	-	-
80	3	1,5	-	-	-
100	3	1,5	-	-	3
120	3	1,5	-	-	3
150	3	1,5	-	-	3
180	4	2	-	-	4
200	4	2	4	2	4
260	6	3	6	3	6
325	6	3	6	3	6
395	6	3	6	3	6
460	6	3	6	3	6
580	10	5 4)	-	-	-
650	10	5 4)	-	-	-
850	12	6 4)	-	-	-
950	12	6 4)	-	-	-
1030	12	6 4)	-	-	-

1) *Measured on fitted bearing with ideal adjacent construction*

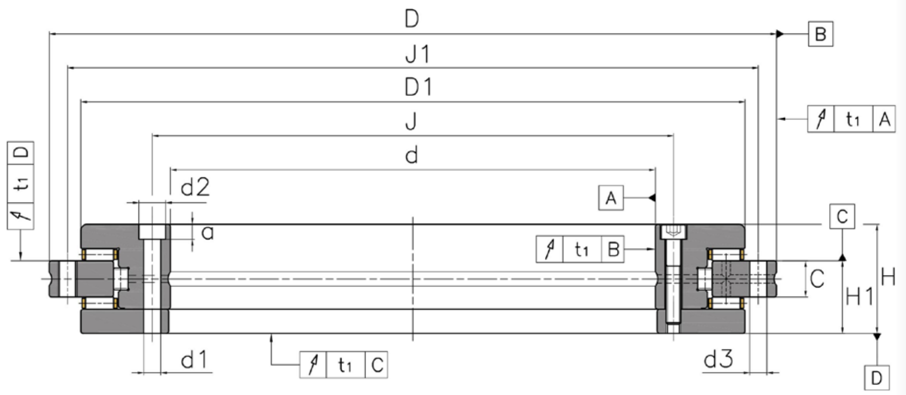
2) *For rotating inner and outer ring*

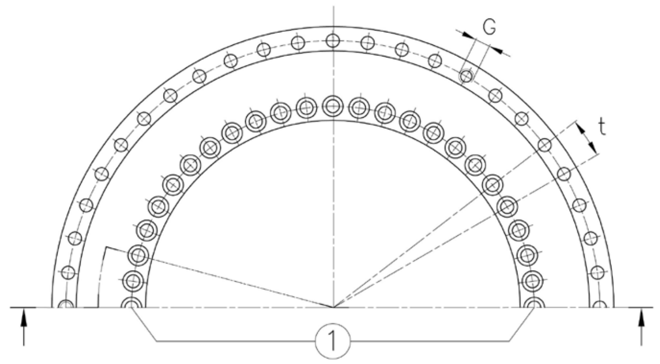
3) *For rotating inner ring only*

4) *Available by agreement*

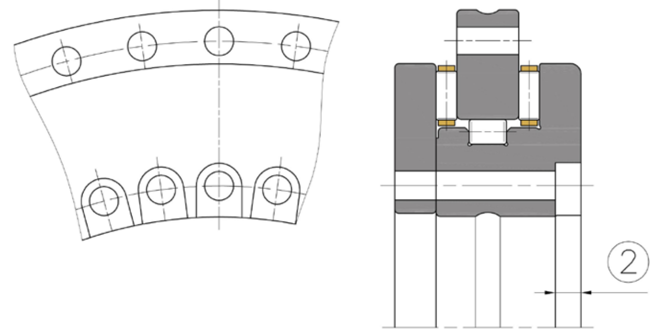
EVRT Series

Axial-radial bearings, double direction





Hole pattern
① Two retaining screws



For EVRT 80 and EVRT 100
② Screw counterbores open [5]

Dimension table

Designation	Main dimensions									Fixing holes: Inner ring				Fixing holes: Outer ring	
	d	D	H	H_1	H_2	C	D_1 max	J	J_1	d_1	d_2	a	Q.ty[4]	d_3	Q.ty[4]
–	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
EVRT 50	**50**	126	30	20	10	10	105	63	116	5,6	9	4,2	10	5,6	12
EVRT 80	**80**	146	35	23,35	11,65	12	130	92	138	5,6	10	4	10	4,6	12
EVRT 100	**100**	185	38	25	13	12	161	112	170	5,6	10	5,4	16	5,6	15
EVRT 120	**120**	210	40	26	14	12	185	135	195	7	11	6,2	22	7	21
EVRT 150	**150**	240	40	26	14	12	214	165	225	7	11	6,2	34	7	33
EVRT 180	**180**	280	43	29	14	15	244	194	260	7	11	6,2	46	7	45
EVRT 200	**200**	300	45	30	15	15	274	215	285	7	11	6,2	46	7	45
EVRT 260	**260**	385	55	36,5	18,5	18	345	280	365	9,3	15	8,2	34	9,3	33

Designation	Pitch t[1]	Threaded extraction hole		Screw tightening torque	Basic load ratings: Axial		Basic load ratings: Radial		Limiting speed[6]	Bearing frictional torque[7]	Mass
	Q.ty x t	G	Q.ty	M_A[2]	C_a dyn	C_{0a} stat	C_r dyn	C_{0r} stat	n_G	M_{RL}	
–	mm	mm	mm	Nm	kN	kN	kN	kN	min^{-1}	~Nm	kg
EVRT 50	12x30°	-	-	8,5	56	280	28,5	49,5	440	2,5	1,6
EVRT 80	12x30°	-	-	8,5	38	158	44	98	350	3	2,4
EVRT 100	18x20°	M5	3	8,5	73	370	52	108	280	3	4,1
EVRT 120	24x15°	M8	3	14	80	445	70	148	230	7	5,3
EVRT 150	36x10°	M8	3	14	85	510	77	179	210	13	6,2
EVRT 180	48x7,5°	M8	3	14	92	580	83	209	190	14	7,7
EVRT 200	48x7,5°	M8	3	14	98	650	89	236	170	15	9,7
EVRT 260	36x10°	M12	3	34	109	810	102	310	130	25	18,3

1) Including retaining screws or threaded extraction holes.

2) Tightening torque for screws to DIN 912 (UNI 5931), grade 10.9.

3) Rigidity values taking account of the rolling element set, the deformation of the bearing rings and the screw connections.

4) Attention!!! For fixing holes in the adjacent construction observe the pitch of the bearing holes.

5) Screw counterbores in the L-section ring open to the bearing bore. The bearing inside diameter is unsupported in the area ②.

6) For high operating durations or continuous operation, please contact us.

7) Measurement speed = 5 min^{-1}.

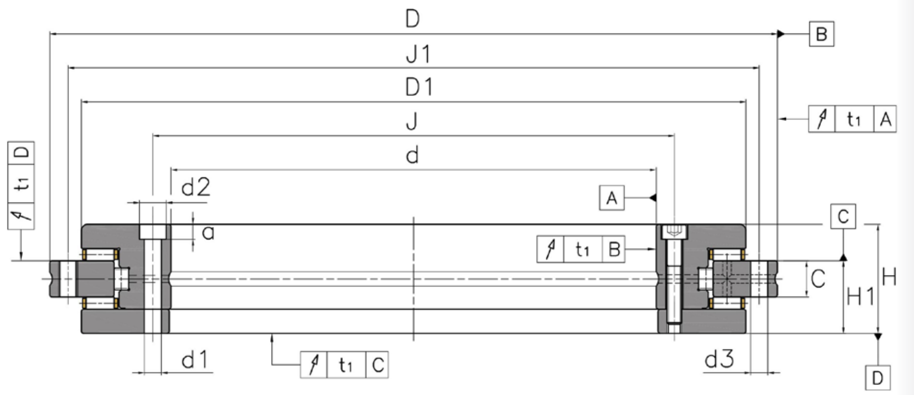
Rigidity

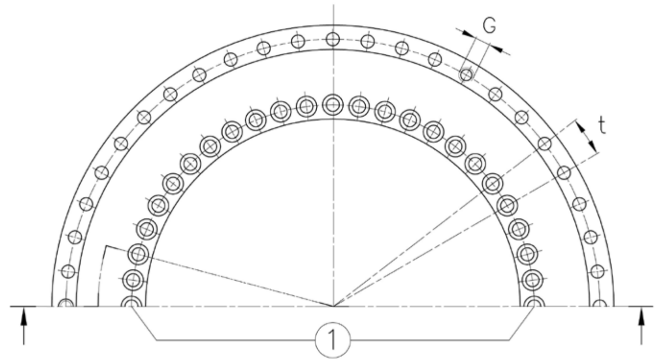
Designation	Rigidity of bearing position [3]			Rigidity of rolling element set		
	Axial	Radial	Tilting rigidity	Axial	Radial	Tilting rigidity
	C_{aL}	C_{rL}	C_{kL}	C_{aL}	C_{rL}	C_{kL}
–	kN/µm	kN/µm	kNm/mrad	kN/µm	kN/µm	kNm/mrad
EVRT 50	1,3	1,1	1,25	6,2	1,5	5,9
EVRT 80[5]	1,6	1,8	2,5	4	2,6	6,3
EVRT 100[5]	2	2	5	6,8	2,4	15
EVRT 120	2,1	2,2	7	7,8	3,8	24
EVRT 150	2,3	2,6	11	8,7	4,6	38
EVRT 180	2,6	3	17	9,9	5,3	57
EVRT 200	3	3,5	23	11,2	6,2	80
EVRT 260	3,5	4,5	45	13,7	8,1	155

Axial/radial bearings - Axial angular contact ball bearings
Dimensional tables

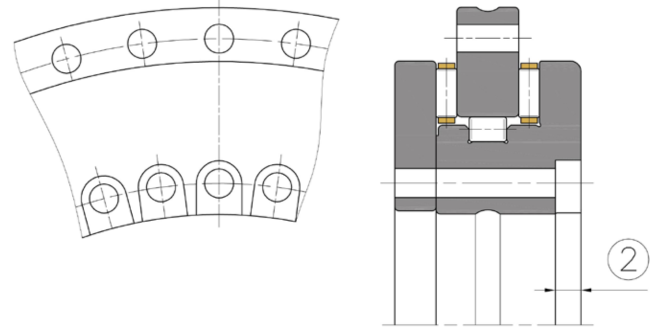
EVRT Series

Axial-radial bearings, double direction





Hole pattern
① Two retaining screws



For EVRT 325
② Screw counterbores open [5)]

Dimension table

Designation	Main dimensions									Fixing holes: Inner ring				Fixing holes: Outer ring	
	d	D	H	H_1	H_2	C	D_1 max	J	J_1	d_1	d_2	a	Q.ty[4)]	d_3	Q.ty[4)]
–	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
EVRT 325	**325**	450	60	40	20	20	415	342	430	9,3	15	8,2	34	9,3	33
EVRT 395	**395**	525	65	42,5	22,5	20	486	415	505	9,3	15	8,2	46	9,3	45
EVRT 460	**460**	600	70	46	24	22	560	482	580	9,3	15	8,2	46	9,3	45
EVRT 580	**580**	750	90	60	30	30	700	610	720	11,4	18	11	46	11,4	42
EVRT 650	**650**	870	122	78	44	34	800	680	830	14	20	13	46	14	42
EVRT 850	**850**	1.095	124	80,5	43,5	37	1.018	890	1.055	18	26	17	58	18	54
EVRT 1030	**1.030**	1.300	145	92,5	-	40	1.215	1.075	1.255	18	26	17	70	18	66

Designation	Pitch t[1)]	Threaded extraction hole		Screw tightening torque	Basic load ratings: Axial		Basic load ratings: Radial		Limiting speed[6)]	Bearing frictional torque[7)]	Mass
	Q.ty x t	G	Q.ty	M_A[2)]	C_a dyn	C_{0a} stat	C_r dyn	C_{0r} stat	n_G	M_{RL}	
–	mm	mm	mm	Nm	kN	kN	kN	kN	min^{-1}	~Nm	kg
EVRT 325	36x10°	M12	3	34	186	1.710	134	415	110	48	25
EVRT 395	48x7,5°	M12	3	34	202	2.010	133	435	90	55	33
EVRT 460	48x7,5°	M12	3	34	217	2.300	187	650	80	70	45
EVRT 580	48x7,5°	M12	6	68	390	3.600	211	820	60	140	89
EVRT 650	48x7,5°	M12	6	116	495	5.200	415	1.500	55	200	170
EVRT 850	60x6°	M16	6	284	560	6.600	475	1.970	40	300	253
EVRT 1030	72x5°	M16	6	284	1.080	11.000	620	2.650	35	800	375

1) Including retaining screws or threaded extraction holes.

2) Tightening torque for screws to DIN 912 (UNI 5931), grade 10.9.

3) Rigidity values taking account of the rolling element set, the deformation of the bearing rings and the screw connections.

4) Attention!!! For fixing holes in the adjacent construction observe the pitch of the bearing holes.

5) Screw counterbores in the L-section ring open to the bearing bore. The bearing inside diameter is unsupported in the area ②.

6) For high operating durations or continuous operation, please contact us.

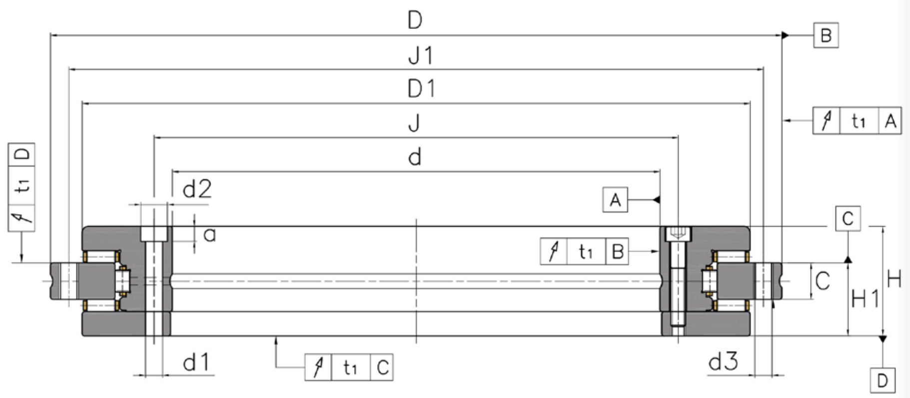
7) Measurement speed = 5 min^{-1}.

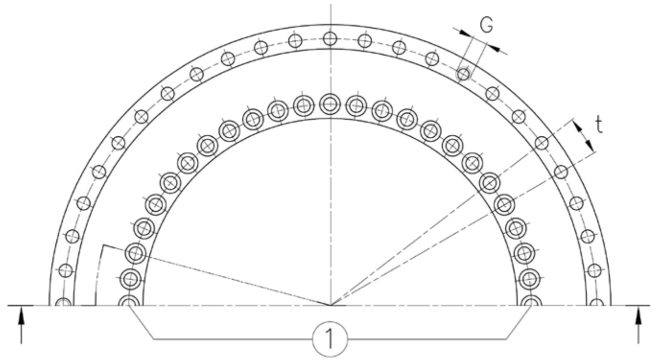
Rigidity

Designation	Rigidity of bearing position [3)]			Rigidity of rolling element set		
	Axial	Radial	Tilting rigidity	Axial	Radial	Tilting rigidity
	C_{aL}	C_{rL}	C_{kL}	C_{aL}	C_{rL}	C_{kL}
–	kN/µm	kN/µm	kNm/mrad	kN/µm	kN/µm	kNm/mrad
EVRT 325[5)]	4,3	5	80	26,1	9,4	422
EVRT 395	4,9	6	130	30,3	11,3	684
EVRT 460	5,7	7	200	33,5	13,9	1.049
EVRT 580	6,9	9	380	42,1	17,4	2.062
EVRT 650	7,6	10	550	58,3	19,7	3.669
EVRT 850	9,3	13	1.100	73,4	20,2	7.587
EVRT 1030	11,2	16	1.900	79,7	18,8	12.025

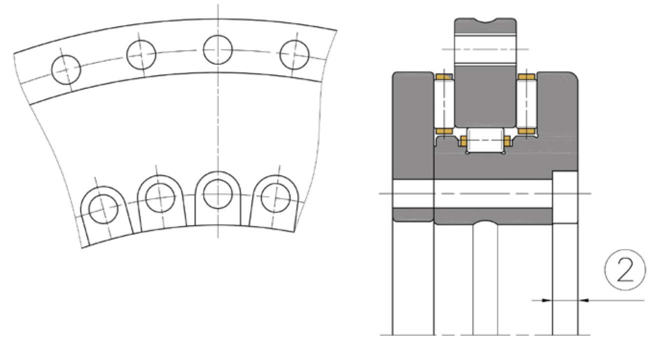
EVRTS Series

Axial-radial bearings, double direction





Hole pattern
① Two retaining screws



For EVRTS 325
② Screw counterbores open [5]

Dimension table

Designation	Main dimensions									Fixing holes: Inner ring				Fixing holes: Outer ring	
	d	D	H	H_1	H_2	C	D_1 max	J	J_1	d_1	d_2	a	Q.ty[4]	d_3	Q.ty[4]
–	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
EVRTS 200	**200**	300	45	30	15	15	274	215	285	7	11	6,2	46	7	45
EVRTS 260	**260**	385	55	36,5	18,5	18	345	280	365	9,3	15	8,2	34	9,3	33
EVRTS 325	**325**	450	60	40	20	20	415	342	430	9,3	15	8,2[5]	34	9,3	33
EVRTS 395	**395**	525	65	42,5	22,5	20	486	415	505	9,3	15	8,2	46	9,3	45
EVRTS 460	**460**	600	70	46	24	22	560	482	580	9,3	15	8,2	46	9,3	45

Designation	Pitch t[1]	Threaded extraction hole		Screw tightening torque	Basic load ratings: Axial		Basic load ratings: Radial		Limiting speed[6]	Mass moment of inertia for rotating [7]: Inner ring	Mass moment of inertia for rotating [7]: Outer ring	Mass
	Q.ty x t	G	Q.ty	M_A[2]	C_a dyn	C_{0a} stat	C_r dyn	C_{0r} stat	n_G	M_M	M_M	
–	mm	mm	mm	Nm	kN	kN	kN	kN	min^{-1}	Kg*cm^2	Kg*cm^2	kg
EVRTS 200	48x7,5°	M8	3	14	155	840	94	226	1.160	667	435	9,7
EVRTS 260	36x10°	M12	3	34	173	1.050	110	305	910	2.074	1.422	18,3
EVRTS 325	36x10°	M12	3	34	191	1.260	109	320	760	4.506	2.489	25
EVRTS 395	48x7,5°	M12	3	34	214	1.540	121	390	650	8.352	4.254	33
EVRTS 460	48x7,5°	M12	3	34	221	1.690	168	570	560	15.738	7.379	45

Rigidity

Designation	Rigidity of bearing position [3]: Axial	Rigidity of bearing position [3]: Radial	Rigidity of bearing position [3]: Tilting rigidity	Rigidity of rolling element set: Axial	Rigidity of rolling element set: Radial	Rigidity of rolling element set: Tilting rigidity
	C_{aL}	C_{rL}	C_{kL}	C_{aL}	C_{rL}	C_{kL}
–	kN/μm	kN/μm	kNm/mrad	kN/μm	kN/μm	kNm/mrad
EVRTS 200	4	1,2	29	13,6	3,9	101
EVRTS 260	5,4	1,6	67	16,8	5,8	201
EVRTS 325[5]	6,6	1,8	115	19,9	7,1	350
EVRTS 395	7,8	2	195	23,4	8,7	582
EVRTS 460	8,9	1,8	280	25,4	9,5	843

1) Including retaining screws or threaded extraction holes.

2) Tightening torque for screws to DIN 912 (UNI 5931), grade 10.9.

3) Rigidity values taking account of the rolling element set, the deformation of the bearing rings and the screw connections.

4) Attention!!! For fixing holes in the adjacent construction observe the pitch of the bearing holes.

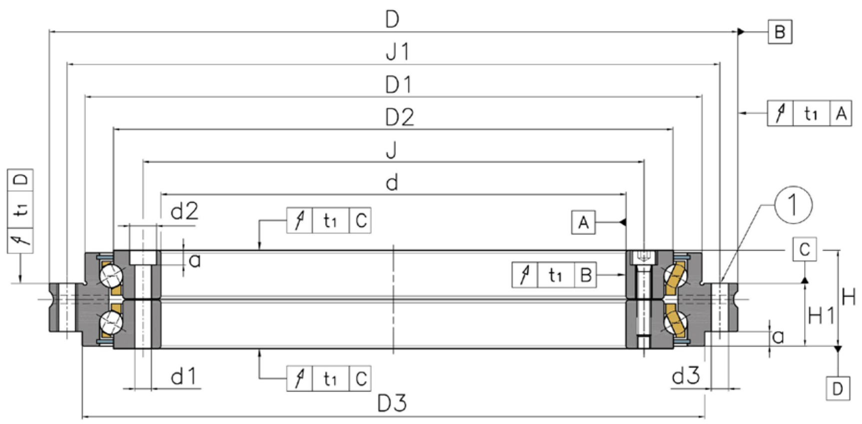
5) Screw counterbores in the L-section ring open to the bearing bore. The bearing inside diameter is unsupported in the area ②.

6) For high operating durations or continuous operation, please contact us.

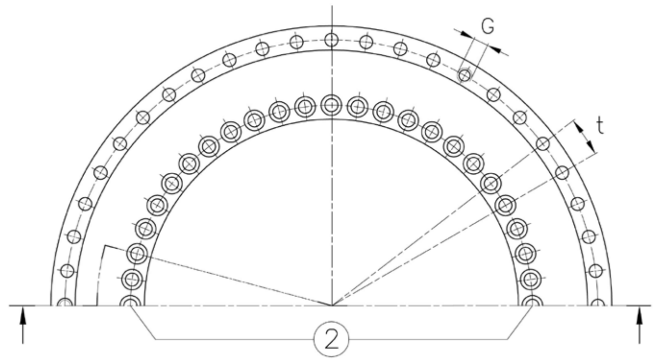
7) Measurement speed = 5 min^{-1}.

EVLDF Series

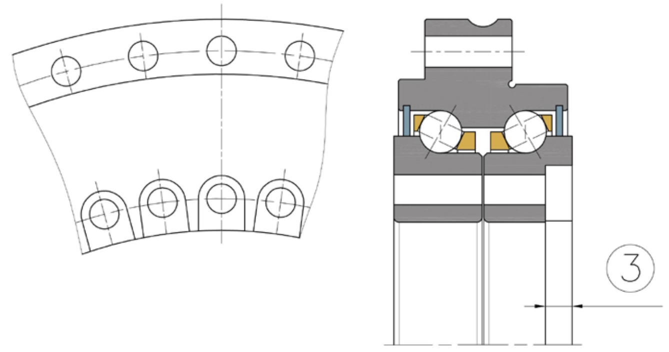
Axial angular contact ball bearings, double direction



① *Contact surface / centring diameter*



Hole pattern
② *Two retaining screws*



For EVLDF 100, EVLDF 325
③ *Screw counterbores open* [5]

Dimension table

Designation	Main dimensions										Fixing holes				
											Inner ring			Outer ring	
	d	D	H	H_1	D_1	D_2	D_3	J	J_1	a	d_1	d_2	Q.ty[4]	d_3	Q.ty[4]
–	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
EVLDF 100	**100**	185	38	25	161	136	158	112	170	5,4	5,6	10	16	5,6	15
EVLDF 120	**120**	210	40	26	185	159	181	135	195	6,2	7	11	22	7	21
EVLDF 150	**150**	240	40	26	214	188	211	165	225	6,2	7	11	34	7	33
EVLDF 180	**180**	280	43	29	244	219	246	194	260	6,2	7	11	46	7	45
EVLDF 200	**200**	300	45	30	274	243	271	215	285	6,2	7	11	46	7	45
EVLDF 260	**260**	385	55	36,5	345	313	348	280	365	8,2	9,3	15	34	9,3	33
EVLDF 325	**325**	450	60	40	415	380	413	342	430	8,2	9,3	15	34	9,3	33
EVLDF 395	**395**	525	65	42,5	486	450	488	415	505	8,2	9,3	15	46	9,3	45
EVLDF 460	**460**	600	70	46	560	520	563	482	580	8,2	9,3	15	46	9,3	45

Designation	Pitch t[1]	Threaded extraction hole		Screw tightening torque	Basic load ratings		Limiting speed[6]	Mass
					Axial			
	Q.ty x t	G	Q.ty	M_A[2]	C_a dyn	C_{0a} stat	n_G	
–	mm	mm	mm	Nm	kN	kN	min^{-1}	kg
EVLDF 100	18x20°	M5	3	8,5	71	265	5.000	3,8
EVLDF 120	24x15°	M8	3	14	76	315	4.300	4,8
EVLDF 150	36x10°	M8	3	14	81	380	3.600	5,6
EVLDF 180	48x7,5°	M8	3	14	85	440	3.500	7,7
EVLDF 200	48x7,5°	M8	3	14	121	610	3.200	10
EVLDF 260	36x10°	M12	3	34	162	920	2.400	19
EVLDF 325	36x10°	M12	3	34	172	1.110	2.000	25
EVLDF 395	48x7,5°	M12	3	34	241	1.580	1.600	33
EVLDF 460	48x7,5°	M12	3	34	255	1.860	1.400	47

Rigidity

Designation	Rigidity of bearing position [3]			Rigidity of rolling element set		
	Axial	Radial	Tilting rigidity	Axial	Radial	Tilting rigidity
	C_{aL}	C_{rL}	C_{kL}	C_{aL}	C_{rL}	C_{kL}
–	kN/µm	kN/µm	kNm/mrad	kN/µm	kN/µm	kNm/mrad
EVLDF 100[5]	1,2	0,35	3,6	2,2	0,35	5
EVLDF 120	1,5	0,4	5,5	2,5	0,4	6
EVLDF 150	1,7	0,4	7,8	2,9	0,4	12
EVLDF 180	1,9	0,5	10,7	2,8	0,5	16
EVLDF 200	2,5	0,6	17,5	3,7	0,6	26
EVLDF 260	3,2	0,7	40	4,7	0,7	54
EVLDF 325[5]	4	0,8	60	5,4	0,8	90
EVLDF 395	4,5	0,9	100	6,3	0,9	148
EVLDF 460	5,3	1,1	175	7,1	1,1	223

1) Including retaining screws or threaded extraction holes.

2) Tightening torque for screws to DIN 912 (UNI 5931), grade 10.9.

3) Rigidity values taking account of the rolling element set, the deformation of the bearing rings and the screw connections.

4) Attention!!! For fixing holes in the adjacent construction observe the pitch of the bearing holes.

5) Screw counterbores in the L-section ring open to the bearing bore. The bearing inside diameter is unsupported in the area ③.

6) For high operating durations or continuous operation, please contact us.

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Features

Thrust crossed roller bearings are highly rigid, have a running accuracy better than P4 and the remaining tolerances to P5, and are preloaded.

The bearing outer rings are easily fixed to the adjacent construction using clamping rings.

The crossed roller bearings described here have a special internal construction that is designed for higher speeds and are optimised for use in vertical turret lathes. In comparison with the bearings described in the previous section, crossed roller bearings of the same size can offer a significantly higher basic dynamic load rating. Due to the smaller number of rolling elements, they have reduced rigidity. The guidelines and values in this chapter relate only to the crossed roller bearings listed in the tables. The bearings are operated with a rotating outer ring.

Axial, radial and moment loads

Due to the O-arrangement of the rollers, these bearings can support axial forces in both directions as well as radial forces, tilting moment loads and any combination of loads by means of a single bearing position. As a result, designs involving two bearing positions can be reduced to a single bearing position, Figure 19 and Figure 20.

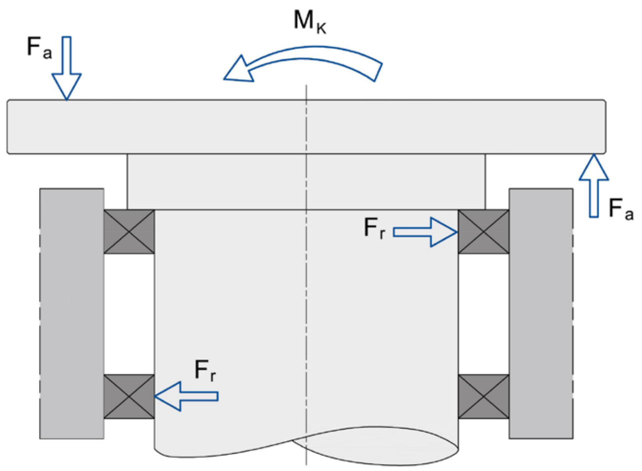
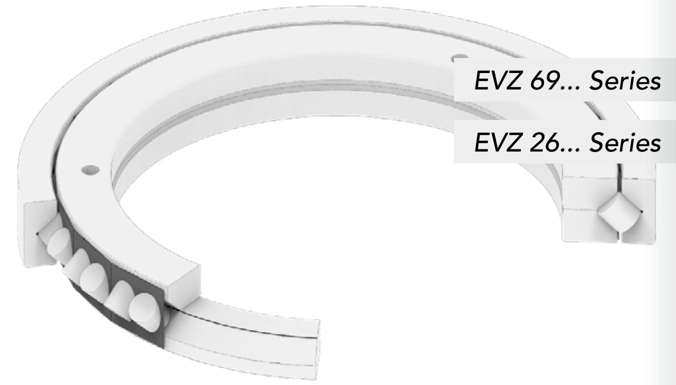


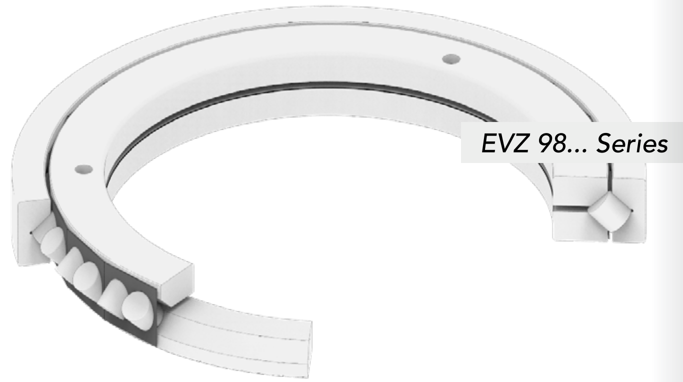
Figure 19
Bearing arrangement with two bearing positions

F_a = Axial load

F_r = Radial load

M_K = Tilting moment





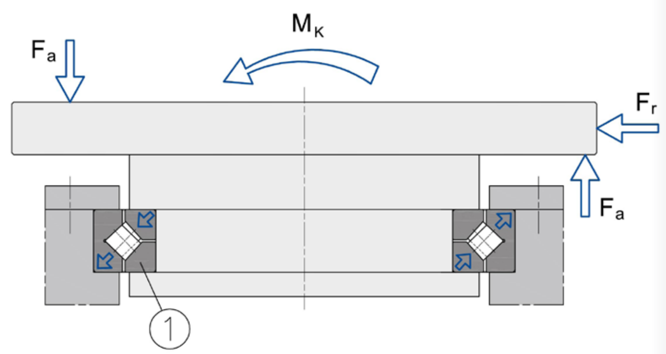


Figure 20
Bearing arrangement with one crossed roller bearing

① *Crossed roller bearing*

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Limiting speeds

The limiting speed is dependent on the lubrication (grease or oil), see table below.

If other limiting speeds are required, please contact us.

Standard clearance	Preload	Peripheral speed
Oil lubrication		up to 8 m/s ($n*D_M$ = 152.800)
Grease lubrication		up to 4 m/s ($n*D_M$ = 76.400)
	Oil lubrication	up to 4 m/s ($n*D_M$ = 76.400)
	Grease lubrication	up to 2 m/s ($n*D_M$ = 38.200)

Preload

In the case of crossed roller bearings **EVZ 69...** and **EVZ 26...** the preload is set at the manufacturing plant and the bearing rings are located by means of appropriate covers and screw connections.

In the case of crossed roller bearings **EVZ 98...** and **EVXR...** the actual height of the inner rings is stated in the record supplied with the bearing.

The required preload of crossed roller bearings with a gap is set by adjustment of the inner rings. This is carried out by means of shims or shim segments that are inserted between the journal and the clamping element on the upper inner ring. It is recommended that the shim thickness is determined according to the following procedure.

The first step is to produce a thicker shim of approx. 0,25 mm to 0,5 mm, which will then give a measurable axial internal clearance.

The provisional shim thickness X_1 is calculated as follows:

$$X_1 = B_i - L + s$$

X_1 [mm] :

Provisional shim thickness

B_i [mm] :

Total width of inner ring according to inspection record

L [mm] :

Measured seat length of shaft

s [mm] :

Thickness of the shim produced,

s = 0,25/0,30/0,35/0,40/0,45/0,5 mm

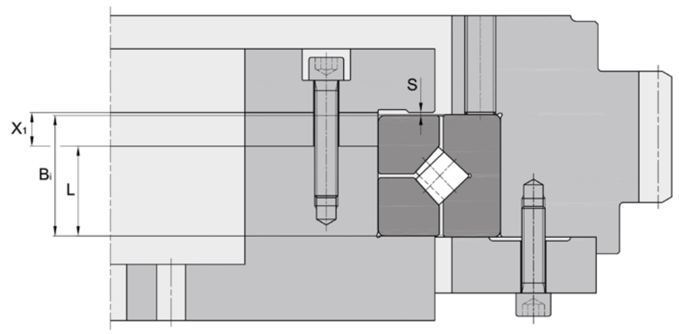

Figure 21
Bearing arrangement with provisional shim thickness X_1

Determining the required shim thickness

After the axial internal clearance has been measured, the final shim thickness **X** is then determined. The axial internal clearance can be determined by lifting the outer ring together with the adjacent parts.

Determining the required shim thickness:

$$X = X_1 - A - V$$

Determining the preload:

$$V = 2 * \frac{\sqrt[1,08]{F_v}}{C_s}$$

X [mm] :

Required shim thickness

X_1 [mm] :

Provisional shim thickness

A [mm] :

Measured axial internal clearance

V [mm] :

Preload

F_V [kN] :

Preload force, recommended value approx.

3,5% of the basic dynamic load rating C

C_S [$kN^{0,926}$/mm] :

Axial spring constant

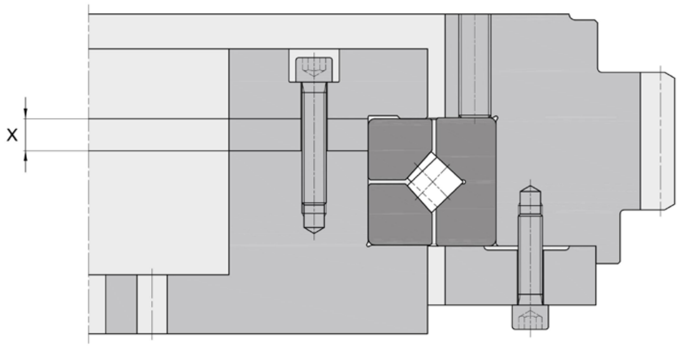

Figure 22

Bearing arrangement with required shim thickness X

Rigidity

Due to the large number of rollers, the bearing has a high axial and radial load carrying capacity. The line contact between the rollers and the raceways also gives high rigidity that is increased further by the preload when the bearing is fitted. The axial displacement δ_a of the crossed roller bearings under a concentric axial force K_a can be determined using the following formulae:

Axial deflection for $K_a \leq 2,114 * F_V$:

$$\delta_a = \frac{K_a}{2,114 * F_v^{0,071} * C_s}$$

Axial deflection for $K_a > 2,114 * F_V$:

$$\delta_a = \frac{\sqrt[1,08]{K_a} - \sqrt[1,08]{F_v}}{C_s}$$

The calculation result only gives the bearing deflection.

The elasticity of the adjacent construction must additionally be taken into consideration.

Sealing

The bearings are of an open design. The sealing arrangement can be designed anywhere within the adjacent construction.

Operating temperature

Crossed roller bearings are suitable for operating temperatures from -30 °C to +80 °C.

Thrust crossed roller bearings
Technical features

Lubrication

The crossed roller bearings can be lubricated with oil or grease.

Grease lubrication

For grease lubrication, a high quality lithium soap grease **KP2N–20** to **DIN 51825** is suitable, such as **SHELL GADUS S5 V100 2**.

For low speeds, and especially for horizontal axes, the simple grease lubrication method should be used. In vertical axes with grease lubrication, a baffle plate should be fitted under the bearing to minimise the escape of grease. We recommend the use of a grease with a lithium soap base and EP additives. When initial greasing is carried out, the space between the rollers should be filled with grease. A relubrication quantity of 20% to 30% of the initial grease quantity is recommended.

Oil lubrication

For oil lubrication, oils CLP to **DIN 51517** or HLP to **DIN 51524** of viscosity classes **ISO VG 46 a ISO VG 68** are suitable.

Recirculating oil lubrication

In general, the recirculating oil lubrication for the crossed roller bearings can also be used for the drive system. If lubrication is to provided for the bearing only, a smaller quantity is sufficient.

If the oil must also provide cooling, as is the case at higher speeds, larger quantities of oil are required, **Figure 23**. In each individual case, the oil quantity actually required can be determined by measuring the temperature of the bearing.

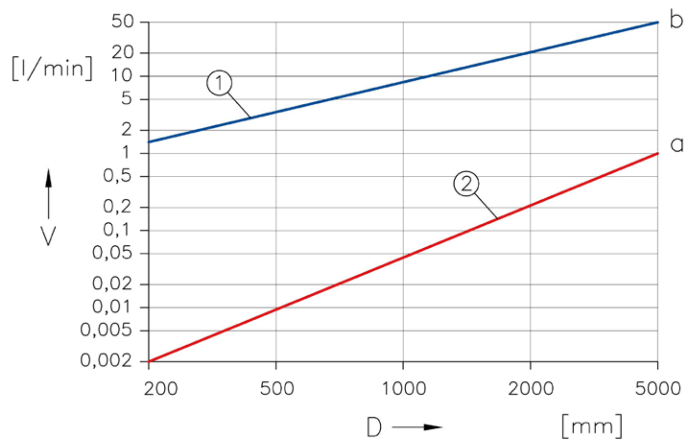

Figure 23

Oil quantities

V = Oil quantity

D = Bearing outside diameter

a = Oil quantity sufficient for lubrication

b = Oil quantity required for cooling and lubrication

① *Lubrication and cooling*

② *Lubrication only*

Kinematic oil viscosity

The kinematic oil viscosity required for adequate lubrication is determined from the reference viscosity V_1.

In this case, it is assumed that the operating viscosity V of the oil (viscosity at operating temperature) is identical to the reference viscosity V_1. The objective should be to achieve a ratio **k** = V/V_1 = 2 , Figure 24).

The reference viscosity is dependent on the bearing diameter **d_M** = (D + d)/2 and the speed. The operating viscosity **V** is determined with the aid of the viscosity/temperature diagram, taking account of the assumed operating temperature and the nominal viscosity at 40°C. An oil with an operating viscosity higher than V_1 at operating temperature will have a positive effect on the fatigue life of the bearing. In addition, the EP additives give adequate lubricity at low speeds. They are also necessary at low **k** values.

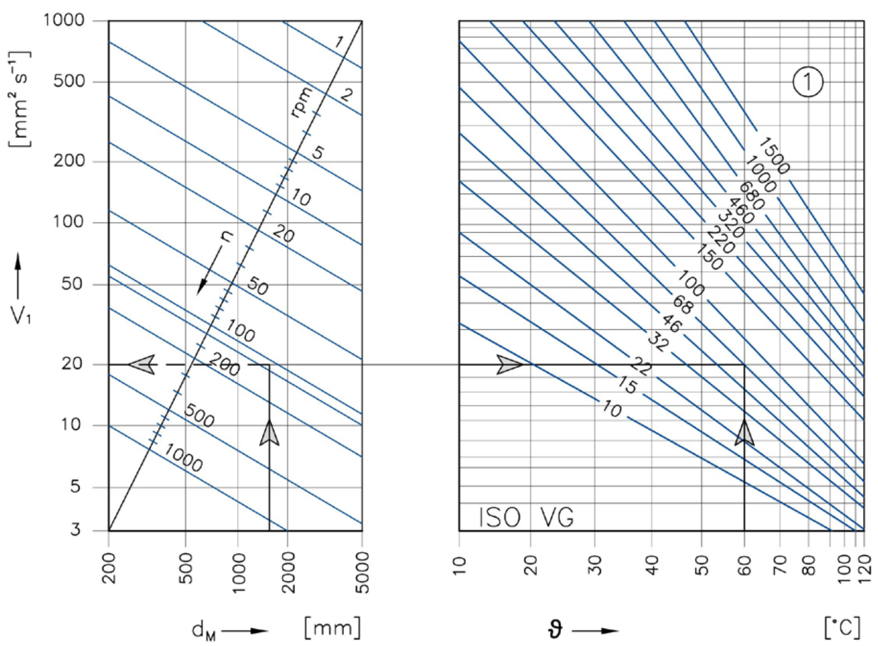

Figure 24

Reference viscosity and V/T diagram for mineral oils

n = Operating speed

V_1 = Reference viscosity

d_M = Mean bearing diameter (d+D)/2

ϑ = Operating temperature

① Viscosity mm²s⁻¹ at 40 °C

Design and safety guidelines

Checking the static load safety factor

The static load safety factor can be checked in approximate terms if the load arrangement is present and all the requirements relating to clamping rings, location, fitting and lubrication are fulfilled, **Figure 20**, **page 28**. In order to check the static load carrying capacity, the following equivalent static operating values must be determined:

- Bearing load F_{oq}
- Tilting moment load M_{oq}

Checking is possible for applications with or without radial load.

Where load arrangements are more complex or the conditions are not fulfilled, please contact us.

Safety factors

For smooth running, the objective should be a factor **f_s** ≥ 4.

Calculation of the rating life

The methods for calculating the rating life are:

- The basic rating life L_{10} and L_{10h} to **UNI-ISO 281** (Contact us for requesting the calculation)
- The simplified form of rating life calculation based on empirical values, see **page 33**.

Validity

The rating life formulae for **L** and **L_h** are only valid:

- With a load arrangement in accordance with **Figure 20**, **page 28**.
- If all the requirements are fulfilled in relation to location (the bearing rings must be rigid or firmly connected to the adjacent construction), fitting, lubrication and sealing.
- If the load and speed in the duty cycle can be regarded as constant during operation.

Simplified form of rating life calculation

In order to provide evidence of the rating life, a simplified form of rating life calculation can be selected for crossed roller bearings within a duty cycle. Within such a duty cycle, the speed and load are regarded as constant. The dynamic factor **f_L** to be achieved in this calculation is an empirical value against which new designs and proven bearing arrangements are compared.

$$f_L = \frac{C}{P} * f_n$$

f_L [-] :

Dynamic factor, see table, **page 34**

For use of crossed roller bearings in machine tools: 3,5 ≤ f_L ≤ 5

C [kN] :

Basic dynamic load rating

f_n [-] :

Speed factor, see table, **page 34**

P [kN] :

Equivalent dynamic bearing load

Calculation of the equivalent dynamic load

The equivalent dynamic bearing load **P** comprises the relevant axial and radial forces, see formulae.

For $F_a/F_r \leq 1,4$:

$$P = 1,4 * F_r + 0,67 * F_a$$

For $F_a/F_r > 1,4$:

$$P = 0,93 * F_r + F_a$$

Preload force, decisive axial force for $K_a \leq 2,114 * F_V$

$$F_a = F_V + 0,5 * K_a$$

Preload force, decisive axial force for $K_a > 2,114 * F_V$

$$F_a = K_a$$

Axial preload:

$$V = 2 * \frac{\sqrt[1,08]{F_v}}{C_s}$$

P [kN] :

Equivalent dynamic bearing load

F_r, F_a [-] :

Axial or radial dynamic bearing load

F_v [kN] :

Preload force

K_a [kN] :

External axial force

V [kN] :

Preload travel

C_S [$kN^{0,926}$/mm] :

Axial rigidity factor

Speed factor f_n for roller bearings

The speed factor f_n is different for each speed value, see table.

Calculation of the speed factor:

$$f_n = \sqrt[\frac{10}{3}]{\frac{33\frac{1}{3}}{n}}$$

Speed factor f_n for roller bearings	
Speed n	Speed factor f_n
min^{-1}	-
1	2,86
2	2,33
3	2,06
4	1,89
5	1,77
6	1,6
7	1,53
8	1,48
9	1,44
10	1,27
15	1,17
20	1,03
30	0,947
40	0,885
60	0,838
70	0,8
80	0,769
90	0,742
100	0,719
150	0,637
200	0,584
300	0,517
400	0,475
500	0,444
600	0,42
700	0,401
800	0,385
900	0,372
1000	0,36
1100	0,35
1200	0,341

Dynamic factor f_L for roller bearings

The rating life L_h can be derived from the dynamic factor, see table.

Calculation of the rating life from the dynamic factor:

$$L_h = 500 * f_L^{10/3}$$

Dynamic factor f_L for roller bearings	
Dynamic factor f_L	Rating life L_h
-	h
1,23	1.000
1,39	1.500
1,52	2.000
1,71	3.000
1,87	4.000
2	5.000
2,11	6.000
2,21	7.000
2,3	8.000
2,38	9.000
2,46	10.000
2,77	15.000
3,02	20.000
3,42	30.000
3,72	40.000
3,98	50.000
4,2	60.000
4,4	70.000
4,58	80.000
4,75	90.000
4,9	100.000

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Shaft and housing tolerances

The inner and outer rings should always have a tight fit. In order to give easier mounting and allow setting of the bearing preload, however, the ring under point load has a less tight fit. In the case of crossed roller bearings in machine tools, this is the inner ring. Crossed roller bearings are therefore mounted with a loose fit on the shaft.

When defining the diameters for the shaft and housing bore, the actual dimensions for the bearing bore and outside diameter are used. The actual dimensions are given in the inspection record included with each bearing.

Mounting tolerances for the shaft

Since the inner ring is subjected to point load, it has a loose fit. As a guide value, it is recommended that the shaft should be machined to give a fit clearance, see formula and table.

$$P = \sqrt[3]{d}$$

P [µm] :

Fit, fit clearance

d [mm] :

Shaft diameter

Thrust crossed roller bearings Mounting tolerances			
d		Roundness Tolerance t_1	Total axial runout Tolerance t_2
>	≤	max	max
mm		µm	µm
-	250	7	4
250	315	7	4
315	400	8	5
400	500	8	6
500	630	9	7
630	800	11	9
800	1000	12	10
1000	1250	14	12
1250	1600	16	13
1600	2000	20	17
2000	2500	23	20
2500	3150	28	23
3150	4000	34	27

Mounting tolerances for the housing bore

Since the outer ring is subjected to circumferential load, it has a tight fit. When machining the housing bore, this should give the following fit interference, see formula and table.

$$P = 0,03 * D$$

P [µm] :

Fit, fit interference

D [mm] :

Housing diameter

Thrust crossed roller bearings Mounting tolerances			
D		Roundness Tolerance t_1	Total axial runout Tolerance t_2
>	≤	max	max
mm		µm	µm
-	315	10	6
315	400	12	7
400	500	12	9
500	630	13	11
630	800	15	13
800	1000	18	15
1000	1250	20	18
1250	1600	23	20
1600	2000	27	25
2000	2500	33	30
2500	3150	39	35
3150	4000	47	40
4000	5000	57	50

Roughness of bearing seats

The roughness of the bearing seats must be matched to the tolerance class of the bearings. The mean roughness value **Ra** must not be too high, in order to maintain the interference loss within limits. Shafts should be ground and bores should be precision turned.

Guide values: see table.

Guide values for roughness of bearing seating surfaces				
Diameter of the bearing seat		Recommended mean roughness values Ra[1] for ground bearing seats Corresponding diameter tolerance		
d (D)		IT6	IT5	IT4
>	≤			
mm		µm	µm	µm
80	500	1,6 (N7)	0,8 (N6)	0,4 (N5)
500	1600	1,6 (N7)	1,6 (N7)	0,8 (N6)
1600	4000	3,2 (N8)	3,2 (N8)	1,6 (N6)

Guide values for roughness of bearing seating surfaces

1) The values in brackets are roughness classes to DIN-ISO 1302.

Location using clamping rings

For location of crossed roller bearings, covers or labyrinth covers have proved effective.

Bearing rings must always be rigidly and uniformly supported over their entire circumference and width.

The thickness of the clamping rings and the contact flanges must be matched to the requirements.

Fixing screws

For location of the bearing rings or clamping rings, screws of **grade 10.9** are suitable.

Any deviations from the recommended size, grade and quantity of screws will considerably reduce the load carrying capacity and operating life of the bearings.

For screws of **grade 12.9**, the minimum strength of the clamping rings must be achieved or quenched and tempered seating washers must be used.

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Securing of screws

Normally, the screws are adequately secured by the correct preload.

If regular shock loads or vibrations occur, however, additional securing of the screws may be necessary.

Not every method of securing screws is suitable for crossed roller bearings.

Never use spring washers or split washers. General information on securing of screws is given in **DIN 25201**, and securing by means of adhesive in particular is described in **DIN 25203**.

If this is to be used, please consult the relevant companies.

Fitting

The bores and edges of the adjacent components must be free from burrs. The support surfaces for the bearing rings must be clean.

The seating and locating surfaces for the bearing rings on the adjacent construction must be lightly oiled or greased.

Lightly oil the thread of the fixing screws in order to prevent varying friction factors (do not oil or grease screws that will be secured by means of adhesive).

Ensure that all adjacent components and lubrication ducts are free from cleaning agents, solvents and washing emulsions.

The bearing seating surfaces can rust or the raceway system can become contaminated.

Mounting forces must only be applied to the bearing ring to be fitted; they must never be directed through the rolling elements or seals.

Avoid direct blows on the bearing rings.

Locate the bearing rings consecutively and without application of any external load.

Once mounting is complete, the operation of the fitted crossed roller bearing must be checked.

If the bearing runs irregularly or roughly, or the temperature in the bearing shows an unusual increase, dismount and check the bearing and mount the bearing again in accordance with the fitting guidelines described.

Accuracy

The running tolerances are based on **DIN 620-2** and **DIN 620-3** and are in a range better than **P4**, see tables. The main dimensions are produced to tolerance **P5**.

Bearings in metric sizes

Inner ring

Dimensional and runout tolerances for bearings in metric sizes

Bearing in metric sizes - Inner ring							
Dimensional and runout tolerances							
Dimensional tolerances						Runout	
Bore		Deviation		Width deviation		Radial runout	Axial runout
d		Δ_{dmp}		Δ_{Bs}		K_{ia}	S_{ia}
>	≤	U	L	U	L	max	max
mm		μm		μm		μm	μm
-	250	0	-20	0	-300	5	5
250	315	0	-23	0	-350	7	7
315	400	0	-25	0	-375	7	7
400	500	0	-27	0	-400	9	9
500	630	0	-30	0	-450	11	11
630	800	0	-35	0	-525	13	13
800	1.000	0	-40	0	-600	15	15
1.000	1.250	0	-46	0	-700	18	18
1.250	1.600	0	-54	0	-800	20	20
1.600	2.000	0	-65	0	-1000	25	25
2.000	2.500	0	-77	0	-1200	30	30
2.500	3.150	0	-93	0	-1400	35	35
3.150	4.000	0	-114	0	-1700	40	40

Outer ring

Dimensional and runout tolerances for bearings in metric sizes

Bearing in metric sizes - Outer ring							
Dimensional and runout tolerances							
Dimensional tolerances						Runout	
Outer diameter		Deviation		Width deviation		Radial runout	Axial runout
D		Δ_{Dmp}, Δ_{Ds}		Δ_{Bs}		K_{ea}	S_{ea}
>	≤	U	L	U	L	max	max
mm		μm		μm		μm	μm
-	315	0	-20	0	-350	K_{ea} & S_{ea} are identical to the associated values of the inner ring	
315	400	0	-23	0	-375		
400	500	0	-25	0	-400		
500	630	0	-27	0	-450		
630	800	0	-30	0	-525		
800	1.000	0	-35	0	-600		
1.000	1.250	0	-40	0	-700		
1.250	1.600	0	-46	0	-800		
1.600	2.000	0	-54	0	-1000		
2.000	2.500	0	-65	0	-1200		
2.500	3.150	0	-77	0	-1400		
3.150	4.000	0	-93	0	-1700		

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Bearings in inch sizes

Inner ring

Dimensional and runout tolerances for bearings in inch sizes

Bearing in inch sizes - Inner ring							
Dimensional and runout tolerances							
Dimensional tolerances						Runout	
Bore		Deviation		Width deviation		Radial runout	Axial runout
d		Δ_{dmp}		Δ_{Bs}		K_{ia}	S_{ia}
>	≤	U	L	U	L	max	max
mm		μm		μm		μm	μm
-	304,8	+13	0	Δ_{Bs}, K_{ia} & S_{ia} are identical to values for the metric sizes			
304,8	609,6	+25	0				
609,6	914,4	+38	0				
914,4	1.219,2	+51	0				
1.219,2	-	+76	0				

Outer ring

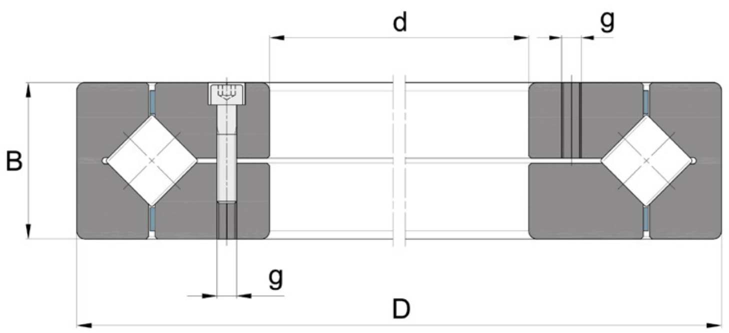
Dimensional and runout tolerances for bearings in inch sizes

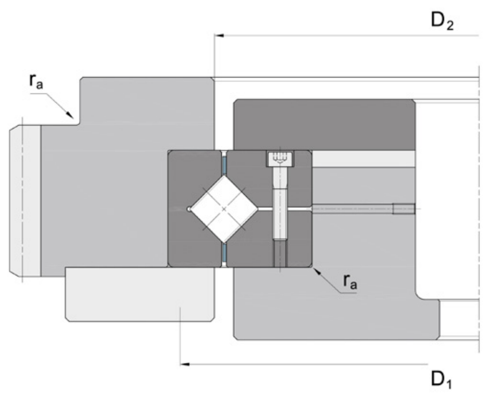
Bearing in inch sizes - Outer ring							
Dimensional and runout tolerances							
Dimensional tolerances						Runout	
Outer diameter		Deviation		Width deviation		Radial runout	Axial runout
D		Δ_{Dmp}, Δ_{Ds}		Δ_{Bs}		K_{ea}	S_{ea}
>	≤	U	L	U	L	max	max
mm		μm		μm		μm	μm
-	304,8	+13	0	Δ_{Bs}, K_{ea} & S_{ea} are identical to values for the metric sizes			
304,8	609,6	+25	0				
609,6	914,4	+38	0				
914,4	1.219,2	+51	0				
1.219,2	-	+76	0				

Thrust crossed roller bearings
Dimensional tables

EVZ 98... Series

Thrust crossed roller bearings, adjustable preload
Metric and inch sizes





Mounting dimensions

Dimension table

Designation	Main dimensions					Mounting dimensions			Basic load ratings		Limiting speeds[2]		Axial spring constant	Initial grease Q.ty	Mass
	d	D	B	r min	g	D_1 min	D_2 max	r_a max	C dyn	C_0 stat	n_G grease	n_G oil	C_s		
–	mm	mm	mm	mm	-	mm	mm	mm	kN	kN	min^{-1}	min^{-1}	$kN^{0,926}/mm$	kg	kg
EVZ 9800[1]	**203,2**	279,4	31,75	1,5	-	233	253	1,5	116	430	450	900	1.110	0,07	6,1
EVZ 9801	**300**	400	38	1,5	-	343	367	1,5	190	815	300	630	1.660	0,13	14
EVZ 9802[1]	**330,2**	457,2	63,5	4	-	383	417	3	320	1.320	280	560	1.880	0,3	33
EVZ 9803	**380**	520	65	4	-	437	477	3	455	1.860	260	530	2.180	0,46	43
EVZ 9804[1]	**414,95**	614,924	65	4	M8	500	540	3	490	2.160	220	450	2.490	0,51	70
EVZ 9805[1]	**457,2**	609,6	63,5	4	-	521	562	3	500	2.280	220	430	2.590	0,53	54
EVZ 9806	**580**	760	80	6	M10	654	704	5	735	3.550	180	360	3.230	0,96	101
EVZ 9807[1]	**685,8**	914,4	79,375	4	M10	784	839	3	930	4.750	150	300	3.810	1,4	152
EVZ 9808	**740**	940	85	5	M10	817	871	4	950	4.900	140	280	3.940	1,5	150
EVZ 9809[1]	**901,7**	1.117,6	82,55	4	M12	987	1.041	3	1.060	6.000	110	220	4.720	1,7	189
EVZ 9810[1]	**1.028,7**	1.327,15	114,3	5	M16	1.147	1.221	4	1.700	9.300	85	170	5.250	3,8	420
EVZ 9811	**1100**	1.350	95	4	M16	1.207	1.268	3	1.370	8.150	80	160	5.550	2,7	305
EVZ 9812[1]	**1270**	1.524	95,25	4	M16	1.379	1.440	3	1.460	9.300	67	130	6.250	3,1	354
EVZ 9813	**1340**	1.600	100	4	M16	1.449	1.517	3	1.760	11.000	60	120	6.600	3,9	400
EVZ 9814[1]	**1.384,3**	1.651	98,425	4	M16	1.500	1.562	3	1.530	10.200	60	120	6.800	3,3	418
EVZ 9815[1]	**1.549,4**	1.828,8	101,6	4	M16	1.669	1.737	3	1.900	12.700	45	90	7.500	4,5	503
EVZ 9816	**1580**	1.870	110	4	M16	1.697	1.768	3	2.080	14.000	48	95	7.600	5,5	573
EVZ 9817[1]	**1.749,872**	2.219,874	190	7,5	M24	1.933	2.055	6	4.500	27.000	60	120	8.450	17	1.850
EVZ 9818[1]	**1.879,6**	2.197,1	101,6	6	M16	1.993	2.088	5	2.080	15.600	36	70	9.050	5,5	689
EVZ 9819	**2100**	2.430	120	6	M20	2.241	2.322	5	2.850	20.800	34	70	9.900	8,5	940
EVZ 9820[1]	**2.463,8**	2.819,4	114,3	6	M20	2.612	2.686	5	2.600	21.200	28	56	11.100	8,5	1.125
EVZ 9821	**3000**	3.380	130	6	M24	3.165	3.252	5	3.600	31.000	24	48	13.200	14	1.652
EVZ 9822	**3500**	3.920	140	6	M30	3.685	3.777	5	4.250	38.000	20	43	15.200	18	2.286
EVZ 9823	**4000**	4.460	155	6	M30	4.202	4.304	5	5.300	49.000	19	38	17.400	25	3.161

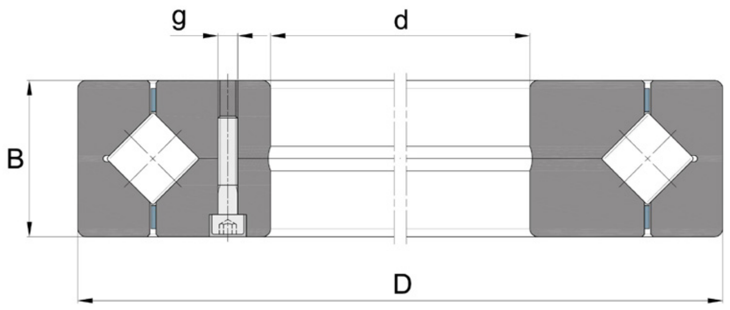
1) Bearings in inch sizes.

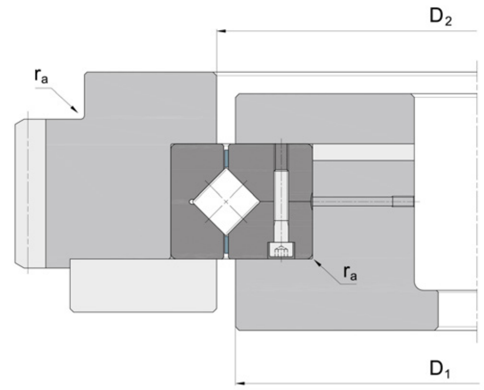
2) The speed limits stated are based on a preload FV 3,5% of C.
If a higher preload FV is present, the speed limits are lower.

Thrust crossed roller bearings
Dimensional tables

EVZ 69..., EVZ 26... Series

Thrust crossed roller bearings, defined preload
Metric and inch sizes





Mounting dimensions

Dimension table

Designation	Main dimensions					Mounting dimensions			Basic load ratings		Limiting speeds[2]		Axial spring constant	Preload force	Initial grease Q.ty	Mass
	d	D	B	r min	g	D_1 min	D_2 max	r_a max	C dyn	C_0 stat	n_G grease	n_G oil	C_s	F_V		
–	mm	mm	mm	mm	-	mm	mm	mm	kN	kN	min^{-1}	min^{-1}	$kN^{0,926}/mm$	kN	kg	kg
EVZ 6904[1]	**203,2**	279,4	31,75	1,5	-	233	253	1,5	122	455	450	900	1.160	4,3	0,07	6,1
EVZ 6905	**300**	400	38	1,5	-	343	367	1,5	200	880	300	630	1.770	7	0,13	14
EVZ 6906[1]	**330,2**	457,2	63,5	4	-	383	417	3	340	1.400	280	560	1.990	12	0,3	33
EVZ 6907	**380**	520	65	4	-	437	477	3	480	2.040	260	530	2.350	17	0,46	43
EVZ 2601[1]	**414,95**	614,924	65	4	M8	500	540	3	520	2.360	220	450	2.580	18	0,51	70
EVZ 6908[1]	**457,2**	609,6	63,5	4	-	521	562	3	540	2.450	220	430	2.790	19	0,53	54
EVZ 6910	**580**	760	80	6	M10	654	704	5	800	3.900	180	360	3.480	28	0,96	101
EVZ 6911[1]	**685,8**	914,4	79,375	4	M10	784	839	3	1.000	5.100	150	300	4.080	35	1,4	152
EVZ 6912	**740**	940	85	5	M10	817	871	4	1.020	5.300	140	280	4.220	36	1,5	150
EVZ 6913[1]	**901,7**	1.117,6	82,55	4	M12	987	1.041	3	1.140	6.550	110	220	5.050	40	1,7	189
EVZ 2602[1]	**1.028,7**	1327,15	114,3	5	M16	1.147	1.221	4	1.800	10.000	85	170	5.600	60	3,8	420
EVZ 6916	**1.100**	1.350	95	4	M16	1.207	1.268	3	1.460	9.000	80	160	6.000	50	2,7	305
EVZ 6917[1]	**1.270**	1.524	95,25	4	M16	1.379	1.440	3	1.560	10.200	67	130	6.750	55	3,1	354
EVZ 6918	**1.340**	1.600	100	4	M16	1.449	1.517	3	1.860	12.000	60	120	7.050	65	3,9	400
EVZ 6919[1]	**1.384,3**	1.651	98,425	4	M16	1.500	1.562	3	1.630	11.200	60	120	7.350	55	3,3	418
EVZ 6920[1]	**1.549,4**	1.828,8	101,6	4	M16	1.669	1.737	3	2.000	13.700	45	90	8.050	70	4,5	503
EVZ 6921	**1.580**	1.870	110	4	M16	1.697	1.768	3	2.200	15.000	48	95	8.050	75	5,5	573
EVZ 2603[1]	**1.749,872**	2.219,874	190	7,5	M24	1.933	2.055	6	4.750	29.000	60	120	8.950	170	17	1.850
EVZ 6923[1]	**1.879,6**	2.197,1	101,6	6	M16	1.993	2.088	5	2.200	17.000	36	70	9.650	75	5,5	689
EVZ 6924	**2.100**	2.430	120	6	M20	2.241	2.322	5	3.000	22.400	34	70	10.500	110	8,5	940
EVZ 6926[1]	**2.463,8**	2.819,4	114,3	6	M20	2.612	2.686	5	2.750	22.800	28	56	11.800	95	8,5	1.125
EVZ 6928	**3.000**	3.380	130	6	M24	3.165	3.252	5	3.800	33.500	24	48	14.000	130	14	1.652
EVZ 6929	**3.500**	3.920	140	6	M30	3.685	3.777	5	4.500	41.500	20	43	16.100	160	18	2.286
EVZ 2604	**4.000**	4.460	155	6	M30	4.202	4.304	5	5.500	53.000	19	38	18.300	190	25	3.161

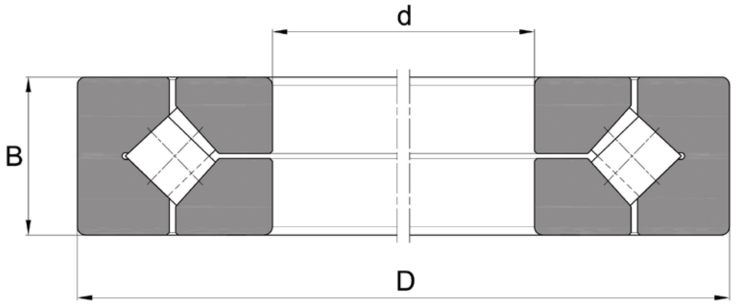
1) Bearings in inch sizes.

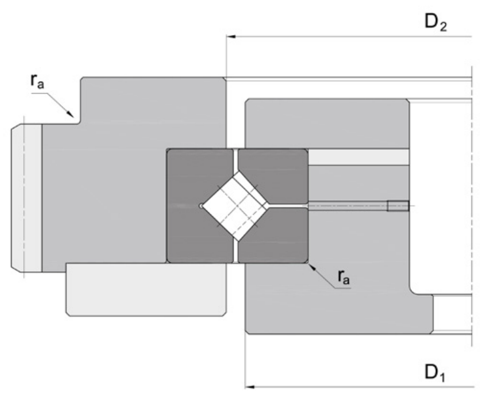
2) The speed limits stated are based on a preload FV 3,5% of C.

If a higher preload FV is present, the speed limits are lower.

EVXR Series

Thrust crossed roller bearings, adjustable preload
Metric and inch sizes





Mounting dimensions

Dimension table

Designation	Main dimensions				Mounting dimensions			Basic load ratings		Limiting speeds[2]		Axial spring constant	Initial grease Q.ty	Mass
	d	D	B	r min	D_1 min	D_2 max	r_a max	C dyn	C_0 stat	n_G grease	n_G oil	C_s		
–	mm	mm	mm	mm	mm	mm	mm	kN	kN	min^{-1}	min^{-1}	$kN^{0,926}/mm$	kg	kg
EVXR 496051[1)]	**203,2**	279,4	31,75	1,5	233	253	1,5	116	430	450	900	1.110	0,07	6,1
EVXR 637050	**300**	400	37	1,5	343	367	1,5	190	815	300	630	1.660	0,13	14
EVXR 652050	**310**	425	45	2,5	357	384	2,5	270	1.020	290	600	1.730	0,15	21,5
EVXR 678052[1)]	**330,2**	457,2	63,5	3,3	383	417	3,3	320	1.320	280	560	1.880	0,3	33
EVXR 699050	**370**	495	50	3	421	447	3	455	1.190	270	540	2.060	0,46	31
EVXR 766051[1)]	**457,2**	609,6	63,5	3,3	521	562	3,3	310	2.280	220	430	2.590	0,53	54
EVXR 820060	**580**	760	80	6,4	654	704	6,4	735	3.550	180	360	3.230	0,96	101
EVXR 855053[1)]	**685,8**	914,4	79,375	3,3	784	839	3,3	930	4.750	150	300	3.810	1,4	152
EVXR 882055[1)]	**901,7**	1.117,6	82,55	3,3	987	1.041	3,3	1.060	6.000	110	220	4.720	1,7	189
EVXR 889058[1)]	**1.028,7**	1.327,15	114,3	3,3	1.147	1.221	3,3	1.700	9.300	85	170	5.250	3,8	420
EVXR 897051[1)]	**1.549,4**	1.828,8	101,6	3,3	1.669	1.737	3,3	1.900	12.700	45	90	7.500	4,5	503
EVXR 903054[1)]	**1.879,6**	2.197,1	101,6	6	1.993	2.088	5	2.080	15.600	36	70	9.050	5,5	689
EVXR 912050[1)]	**2.463,8**	2.819,4	114,3	6	2.612	2.686	5	2.600	21.200	28	56	11.100	8,5	1.125

1) Bearings in inch sizes.

2) The speed limits stated are based on a preload FV 3,5% of C.
If a higher preload FV is present, the speed limits are lower.

Please refer to tolerances for bearings in inch sizes at page 39 for both metric and inch sizes EVXR bearings.

For special requirements please contact our technical department.

Notes

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products to meet the specific needs of each of our clients