https://www.schaeffler.de/std/1D65

Crossed roller bearings



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Matrix for bearing preselection

The matrix gives an overview of the types and design features of crossed roller bearings.

It can be used to make a preliminary assessment of whether a bearing is fundamentally suitable for the envisaged application. The additional information provided in the product chapter (see column "detailed information") and in the Technical principles must, however, be observed in addition to this overview in selection of the bearing.

Design features and suitability					Crossed roller bearings	
+++ extremely suitable ++ highly suitable + suitable (+) suitable with restrictions - not suitable/not applicable ✓ available				detailed information		
					1142	
Load carrying	radial		F,	++	▶1143 1.2	
capacity	axial, one direction		→ F _a	+++	▶1143 1.2	
	axial, both directions		Fa	+++	▶1143 1.2	
	moments		М	++	▶1143 1.2	
Compen- sation of	static		1	_	▶1144 1.3	
angular mis- alignments	dynamic		4		▶1144 1.3	
Bearing design	cylindrical bore				▶1142 1.1	
Ū	tapered bore			_		
	separable				▶1163 1.17	
Lubrication greased		. 76	✓	▶1144 1.4		
Sealing	open		M	✓	▶1145 1.5	
	non-contact			_	▶1145 1.5	
	contact			_	▶1145 1.5	
		from to		-30 +100	▶1146 1.8	
Suitability for	high speeds		On	(+)	▶1146 1.6	
	high running accuracy		11	++	➤ 1150 ➤ 1147 1.11	
	low-noise running			+	▶1146 1.7	
	high rigidity reduced friction		8	+	▶1150	
			0	+	▶56	
	length compensation within bearing					
	non-locating bearing arrangement		0		▶139	
	locating bearing arrangement			+	▶139	
X-life bearing	X-life bearings					
Bearing bore d _i in mm fro			(Z)	70 500	▶1168	
Product table	s from pa			1168		



1 Crossed roller bearings



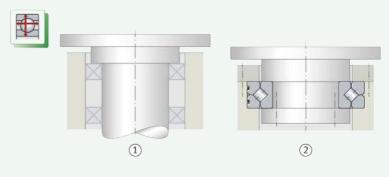
Crossed roller bearings SX:

- are suitable, due to their high running accuracy, as bearings for high precision applications (such as those in robots, machine tools, handling systems, precision mechanical and medical devices, vehicle components)
- correspond in their main dimensions to the ISO dimension series 18 with very small section height
- can support axial forces in both directions, radial loads, tilting moments and any combination of loads ➤ 1143 | 1.2
- usually allow designs with two bearing positions to be replaced by one bearing position $\triangleright 1142$ \bigcirc 1
- are very rigid (they can be supplied with normal clearance, clearance-free or preloaded) ➤ 1168 | ===
- are suitable for compressive and suspended arrangements
- are always a good choice for a technically and economically leading bearing solution if compact and easy-to-fit rolling bearings with high tilting moment carrying capacity and rigidity, with uniform running free from stick-slip, low rotational resistance as well as high axial and radial runout accuracy are required in only one bearing position.

For an overview of other product-specific features, see the Matrix for bearing preselection > 1141.

Comparison:
bearing arrangement
with two bearing positions/
bearing arrangement
with a crossed roller bearing SX

- Bearing arrangement
 with two bearing positions
- 2 Bearing arrangement with one crossed roller bearing SX



1.1

Bearing design

Crossed roller bearings SX are compact locating bearings with high axial rigidity Crossed roller bearings SX are bearings for high precision applications, whose main dimensions correspond to the ISO dimension series 18 with very small section height in accordance with DIN 616. They comprise outer rings, inner rings, rolling elements and plastic spacers. The outer ring is split in the circumferential direction and is held together by three sheet metal retaining rings > 1143 \rightarrow 2. The cylindrical rollers correspond to DIN 5402 and are in an X arrangement with each other on the raceways. The bearings are very rigid, have high running accuracy and are supplied with normal clearance, low clearance or preload. Bearings with preload have the suffix VSP, while bearings with low clearance have the suffix RLO > 1147 \rightarrow 3. The bearing outer rings are easily fixed to the adjacent construction using clamping rings > 1159.

https://www.schaeffler.de/std/1D65

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Also available in a corrosion-resistant design

For applications requiring high corrosion protection, the bearings are also available in a corrosion-resistant design with the special coating Corrotect > 109.

 \bigcirc **2** Crossed roller bearing SX

- (1) Split outer ring
- (2) Sheet metal retaining ring
- (3) Lubrication hole (3) Lubrication holes distributed over the circumference)
- (4) Plastic spacers





Permissible circumferential velocities

Influencing factors

The possible circumferential velocity is dependent on the bearing (normal clearance or preloaded) and on the lubrication (grease or oil) $\triangleright 1143$ $| \equiv 1$.



D_M = rolling element pitch circle diameter ➤ 1168

Normal clearance	Preload	Circumferential velocity
Oil lubrication	_	up to 8 m/s (n \cdot D _M = 152 800)
Grease lubrication	_	up to 4 m/s (n · $D_M = 76400$)
-	Oil lubrication	up to 4 m/s (n · $D_M = 76400$)
-	Grease lubrication	up to 2 m/s (n · $D_M = 38200$)

<u>1.2</u>

Load carrying capacity

Suitable for axial loads in both directions, radial loads and tilting moment loads

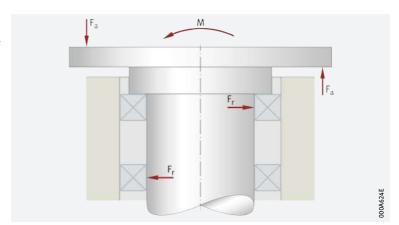
Due to the X arrangement of the cylindrical rollers, the bearings can support axial forces in both directions, radial loads, tilting moment loads and any combination of loads by means of a single bearing position > 1144 \cong 4. As a result, it is generally possible to reduce conventional bearing arrangements comprising two bearing positions (bearing arrangement with one radial and one axial bearing) to one bearing position > 1144 \cong 3 and > 1144 \cong 4. This reduces the work required and the costs for the design of the adjacent construction (only one bearing position is processed) and considerably reduces the mounting of the bearings (there is no requirement for the matching of two bearings to each other).

Conventional bearing arrangement with two bearing positions

 $F_r = radial load$

 $F_a = axial load$

M = tilting moment load



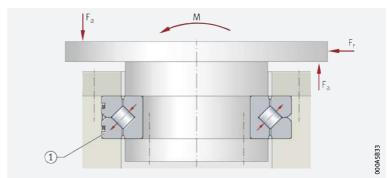
Optimised bearing arrangement with one crossed roller bearing

 $F_r = radial load$

 $F_a = axial load$

M = tilting moment load

1) Crossed roller bearing SX



1.3 Angular adjustment facility



Crossed roller bearings SX cannot be used for the compensation of misalignments. These bearings are precision bearings for high precision applications. In order to ensure their correct function, it is essential that the specifications for design of the adjacent construction are observed > 1158 | 1.16. Skewing of the bearing rings increases the running noise, places increased strain on the plastic spacers, has a negative effect on the running accuracy and a highly detrimental influence on the operating life of the bearings.

1.4 Lubrication

Grease or oil lubrication is possible

The bearings are greased as standard but can alternatively be lubricated with oil. The decisive factors in determining the type of lubrication and the requisite lubricant quantity are:

- the size of the bearing
- the design of the bearing environment
- the lubricant feeds
- the operating conditions.



If there is any uncertainty as to whether the lubricant or type of lubrication is suitable for a particular application, please consult Schaeffler or the lubricant manufacturer respectively.

Grease lubrication

Suitable greases

If the bearing is to be lubricated with grease, a high quality lithium soap grease to DIN 51825–KP2N–20 is suitable, for example Arcanol LOAD150 or LOAD220.

https://www.schaeffler.de/std/1D65

https://www.schaeffler.de/std/1D65

Lubrication intervals

on the lubrication interval

The lubrication intervals are essentially dependent on:

- the operating conditions
- the environmental influences such as contamination, water, etc.
- the type of bearings.

Precise lubrication intervals can only be determined by means of tests under the specific application conditions. The observation period selected must be sufficiently long and the condition of the grease must be checked at regular intervals.

Grease operating life

If relubrication is not possible, the grease operating life becomes the decisive factor. Based on experience, the guide value for the grease operating life in the majority of applications is higher by a factor of 2 than the guide value for the lubrication interval. At operating temperatures above +70 °C, the lubrication interval and therefore the grease operating life are reduced. In order to ensure operational reliability, the grease operating life should not exceed 3 years.

Oil lubrication

Selection of the oil A lubricant film which is capable of supporting loads must form in the contact zones between the rolling elements and the raceway. Depending on the operating speed, the oil at operating temperature must have at least the nominal viscosity v_1 . The guide value for v_1 is dependent on the mean bearing diameter d_M and the speed.

of temperature on viscosity

As the temperature increases, the viscosity of the oil decreases. When selecting the viscosity, the lower operating temperature must also be taken into consideration. With increasing viscosity, the flowability of the lubricant is reduced. As a result, the level of power losses will increase.

Suitable oils

For oil lubrication, suitable oils are type CLP to DIN 1517 or HLP to DIN 51524 of the viscosity classes ISO VG 10 to 100.

With oil lubrication. oil change intervals

At higher temperatures, aged oil and additives in the oil can impair the operating life of the plastic used for the spacers. Stipulated oil change must be observed intervals must therefore be observed.

Sealing

Provide seals in the adiacent construction

Crossed roller bearings SX are not sealed. As a result, sealing of the bearing position must be carried out in the adjacent construction. This must reliably prevent:

- moisture and contaminants from entering the bearing
- the egress of lubricant from the bearing.

Schaeffler seal profiles

Material by the metre for radial and/or axial sealing of the bearing position

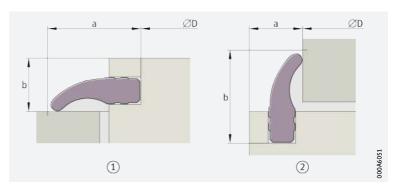
For sealing of the bearing position in the adjacent construction, Schaeffler supplies various seal profiles by the metre $\triangleright 1146 \bigcirc 5$. These profiles are intended for axial and/or radial sealing and – depending on the seal profile – fulfil a wide range of requirements (for example: under normal requirements for sealing, under heavy contamination, for low frictional torque, if only limited space is available, for sealing of fluids, at low speeds or under swivel operation). In addition to the seal profiles with a radial or axial sealing effect respectively, double direction profiles (with both axial and radial sealing effect) are also available. Mounting drawings can be requested for the individual seal profiles.



The seal profiles are not suitable for applications that require leakage-free operation; this applies not only to oil but also to grease lubrication. If leakage losses are unacceptable, measures such as rotary shaft seals can be used. The area around the bearing seal must be designed such that the seal profiles are not damaged during operation.

www.schaeffler.de/en 1145

- (1) Axial sealing
- (2) Radial sealing



Seal profile material

The standard material for the profiles is the synthetic elastomer NBR 70. This material has good resistance to oil and grease as well as good wear resistance. Operating temperature of seal profiles $> 1146 \mid \boxplus 2$. For further information on the seal profiles, please contact Schaeffler.



1.6 Speeds

Limiting speeds in the product tables Rolling bearings cannot rotate at unspecified high speeds, but are generally restricted by the operating temperature that is permissible in relation to the lubricant and the material of the bearing parts $> 1146 \mid 1.8$. The product tables give the kinematic limiting speeds n_G oil and n_G grease for the bearings $> 1168 \mid \frac{1}{100} \mid 1.8$.



The limiting speeds n_G oil and n_G grease are the kinematically permissible speeds for a bearing and apply to oil and grease lubrication respectively. Even under favourable mounting and operating conditions, these speeds must not be exceeded without prior consultation with Schaeffler.

1.7

Noise

Schaeffler Noise Index

The Schaeffler Noise Index (SGI) is not yet available for this bearing type ▶69. The data for these bearing series will be introduced and updated in stages.

Further information:

■ *medias* > https://medias.schaeffler.com.

1.8

Temperature range

Limiting values

The operating temperature of the bearings is limited by:

- the dimensional stability of the bearing rings and cylindrical rollers
- the material of the plastic spacers
- the lubricant
- the seal material in the adjacent construction.

Possible operating temperatures of the bearings $> 1146 \parallel \equiv 2$.



Operating temperature	Crossed roller bearings	Schaeffler seal profiles
	−30 °C to +100 °C	-40 °C to +80 °C



In the event of anticipated temperatures which lie outside the stated values, please contact Schaeffler.

Cages

by plastic spacers

The rollers are guided In the crossed roller bearings SX, the rolling elements are separated from each other and guided not by typical rolling bearing cages but by plastic spacers ►1143 \@ 2. The plastic selected and the design of the running surfaces for the cylindrical rollers give low-friction running of the bearings.

Internal clearance

The crossed roller bearings are available:

- with normal clearance (radial and axial clearance > 1168
- with low clearance (radial clearance/preload > 1168
- with preload VSP (preload min. and max. > 1168 | |||||).

Dimensions, tolerances

Dimension standards



The main dimensions of crossed roller bearings correspond to dimension series 18 in accordance with DIN 616.

Tolerances



The dimensional and running tolerances are based on DIN 620-2 and DIN 620-3 and are in the range P6 and P5.

Suffixes

For a description of the suffixes used in this chapter $> 1147 \parallel 3$ and *medias* interchange ➤ https://www.schaeffler.de/std/1D52.



Suffix	Description of suffix		
RR	Corrosion-resistant design, with Corrotect coating	Special design, available by agreement	
RLO	Low clearance	Standard	
VSP	Preloaded	Special design, available by agreement	
VSP+PRL50	Preloaded, axial and radial runout tolerance restricted by 50%	Special design, available by agreement	

Structure of bearing designation

Example of composition of bearing designation

Crossed roller bearing SX, preloaded, corrosion-resistant (with Corrotect coating):

designation structure

The designation of bearings follows a set model. Example $\geq 1147 \bigcirc 6$.



https://www.schaeffler.de/std/1D65

.14 Dimensioning

Static load carrying capacity

loading, the static load carrying capacity applies

Crossed roller bearings that undergo rotary motion only infrequently, undergo slow swivel motion, rotate only slowly or are subjected to load while stationary are dimensioned on the basis of their static load carrying capacity. The size of a statically loaded bearing can therefore be checked in approximate terms using the basic static load ratings C₀ and the static limiting load diagrams.

Checking the static load carrying capacity

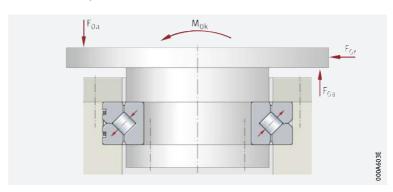
It can be checked in approximate terms if the correct load arrangement is present and all the requirements relating to clamping rings, location, mounting and lubrication are fulfilled $\triangleright 1148 \bigcirc 7$.



Where load arrangements are more complex or there are variations from the conditions, please contact us.

 Θ 7 Load arrangement

 $F_{0a} = axial static bearing load$ F_{Or} = radial static bearing load M_{0k} = static tilting moment load



In order to check the static load carrying capacity, the following equivalent static operating values must be determined:

- the equivalent static bearing load F_{0a}
- the equivalent static tilting moment load M_{0q} .

Checking is possible for applications with or without radial load.

Determining the equivalent static bearing load without radial load

In the presence of axial and tilting moment loads only ≥ 1148 ± 1 and ►1148 £2:

Equivalent axial bearing load (static)

$$F_{0q} \triangleq F_{0a} \cdot f_A \cdot f_S$$

 $M_{0a} \triangleq M_{0k} \cdot f_A \cdot f_S$

_f.]**2** Equivalent tilting moment load (static)

Legend

F_{0q}	kN	Equivalent axial bearing load (static)
F _{0a}	kN	Axial static bearing load
f_A	-	Application factor ➤ 1150 # 4
f_S	_	Factor for additional safety ➤ 1150
ΛΛ	lcNlm	Equivalent tilting moment load (static)

F_{0q}	kN	Equivalent axial bearing load (static)
F_{0a}	kN	Axial static bearing load
f_A	_	Application factor ➤ 1150 🖽 4
f_S	-	Factor for additional safety ➤ 1150
M_{0q}	kNm	Equivalent tilting moment load (static)
M _{Ok}	kNm	Static tilting moment load.

The values for F_{0q} and M_{0q} are used to determine the load point in the static limiting load diagram for the raceway ≥ 1168

In addition to the raceway, the dimensioning of the fixing screws must also be checked.

The static limiting load diagrams for the raceway and the fixing screws are indicated in the product tables.



The load point must lie under the raceway curve, otherwise the bearing is not adequately dimensioned.

Determining the equivalent static bearing load with radial load



Radial loads can only be taken into consideration if the radial load F_{0r} is smaller than the basic static radial load rating $C_{0r} > 1168$.

The equivalent static bearing load with radial load is determined as follows:

- Calculate the parameter for the load eccentricity ∈ according to ▶1149 £3
- Determine the static radial load factor f_{0r}. In this case:
 - determine the ratio F_{0r}/F_{0a} in ►1149 ⊕ 8 or ►1150 ⊕ 9 respectively
 - based on the ratio F_{0r}/F_{0a} and ϵ , determine the static radial load factor f_{0r} from $\triangleright 1149$ \bigcirc 8 or $\triangleright 1150$ \bigcirc 9 respectively
- Calculate the equivalent axial bearing load F_{0q} and the equivalent tilting moment load M_{0q} using the equations ➤ 1149 ∮ 4 and ➤ 1149 ∮ 5



The load point must lie under the raceway curve, otherwise the bearing is not adequately dimensioned.

f**3** Load eccentricity parameter

$$\epsilon = \frac{2000 \cdot M_{0k}}{F_{03} \cdot D_{M}}$$

f| **4** Equivalent bearing load (static)

$$F_{0q} = F_{0a} \cdot f_A \cdot f_S \cdot f_{0r}$$

f_**] 5.** Equivalent tilting moment load (static)

$$M_{Oq} = M_{Ok} \cdot f_A \cdot f_S \cdot f_{Or}$$

Legend

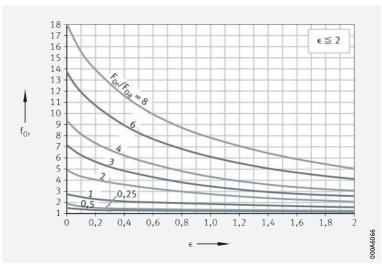
€	_	Load eccentricity parameter
M_{0k}	kNm	Static tilting moment load
F _{0a}	kN	Axial static bearing load
D_{M}	mm	Rolling element pitch circle diameter ➤ 1168
F_{0q}	kN	Equivalent bearing load (static)
f _A	_	Application factor ► 1150 ± 4
f_S	-	Factor for additional safety ► 1150
f _{or}	_	Static radial load factor ►1149 ⊕ 8 or ►1150 ⊕ 9
M _{Oq}	kNm	Equivalent tilting moment load (static).



 $f_{Or} = static \ radial \ load \ factor$

 $\epsilon = load$ eccentricity parameter; $\epsilon \leq 2$

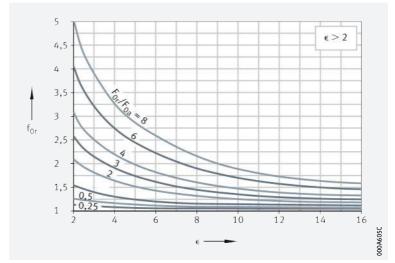
 $F_{0a} = axial static bearing load$ $F_{0r} = radial static bearing load$



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 $f_{Or} = static radial load factor$ ϵ = load eccentricity parameter; $\epsilon > 2$

 F_{0a} = axial static bearing load F_{0r} = radial static bearing load



Application factors

The application factors f_A are empirical values obtained in practice such as the type and severity of operation, rigidity and running accuracy. If the precise requirements of an application are known, the values may be altered accordingly.



Application factors < 1 must not be used.

A large proportion of applications can be statically calculated using the factor 1, for example in the case of bearings for gearboxes and rotary tables.

In addition to static calculation, the rating life should also always be checked ≥ 1152 .



Application	Operating and requirement criteria	Application factor f _A
Robots	Rigidity	1,25
Antennae	Accuracy	1,5
Machine tools	Accuracy	1,5
Metrology	Smooth running	2
Medical equipment	Smooth running	1,5

Safety factors

The factor for additional safety f_S is 1.



It is not normally necessary to factor in any additional safety in calculation. In special cases, such as approval specifications, internal specifications, requirements stipulated by inspection bodies etc., the appropriate safety factors must be applied.

Calculation example

The static load carrying capacity of the crossed roller bearing SX011860 is to be checked.

 $F_{0a} = 70 \text{ kN}$ Static bearing load (axial) Static bearing load (radial) $F_{0r} = 17,5 \text{ kN}$ Static tilting moment load M_{0k} = 22,5 kNm Rolling element pitch circle diameter $D_{M} = 340 \text{ mm}$ Application factor $f_A = 1,25$ Safety factor = 1

Required Static load carrying capacity of the bearing

https://www.schaeffler.de/std/1D65

£16 Load eccentricity parameter

 $2000 \cdot M_{0k}$ $F_{0a} \cdot D_{M}$



$$\epsilon = \frac{2000 \cdot 22,5}{70 \cdot 340} = 1,89$$

$$\frac{F_{0r}}{F_{0a}} = \frac{17.5}{70} = 0.25$$

$$f_{0r} = 1,2$$

Legend

ε	-	Load eccentricity parameter
M_{0k}	kNm	Static tilting moment load
F_{0a}	kN	Static bearing load (axial)
D _M	mm	Rolling element pitch circle diameter
For	kN	Static bearing load (radial)
f _{0r}	-	Static radial load factor $\triangleright 1149$ $\bigcirc 8$ or $\triangleright 1150$ $\bigcirc 9$.

_f_1**7** Equivalent bearing load (static)

$$F_{0q} = F_{0a} \cdot f_A \cdot f_S \cdot f_{0r}$$

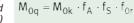


$$F_{0q} = 70 \cdot 1,25 \cdot 1 \cdot 1,2 = 105 \text{ kN}$$

Legend

F_{0q}	kN	Equivalent bearing load (static)
F_{0a}	kN	Static bearing load (axial)
f _A	_	Application factor
f_S	_	Factor for additional safety.

_f_1**8** Equivalent tilting moment load (static)





$$M_{0a} = 22,5 \cdot 1,25 \cdot 1 \cdot 1,2 = 33,75 \text{ kNm}$$

~ 9		
M _{Oa}	kNm	Equivalent tilting moment load (static)
M_{0k}	kNm	Static tilting moment load
f_A	-	Application factor
f_S	-	Factor for additional safety.

Determining the load point in the static limiting load diagram checking the static load carrying capacity

Using the values for F_{0q} and M_{0q} , the load point in the static limiting load diagrams for the raceway and fixing screws is determined ightharpoonup 1152 \hookrightarrow 10 and ►1152 🗁 11.

The load point is below the raceway and screw curves. The bearing is adequately dimensioned and thus suitable for the application.

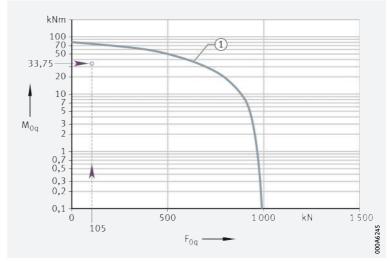


 \ominus 10 Static limiting load diagram for raceway - compressive load

 $M_{0q} = equivalent tilting moment$ load

 $F_{0q} = equivalent bearing load$

(1) Raceway curve

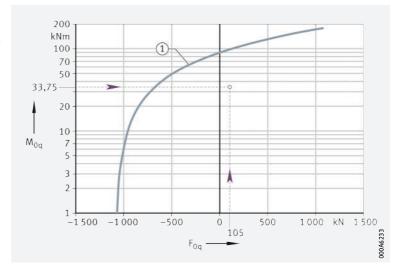


⊕11 Static limiting load diagram for fixing screws - compressive load

 $M_{0q} = equivalent tilting moment$

 $F_{0q} = equivalent bearing load$

(1) Screw curve



Dynamic load carrying capacity

dynamic loading, the dynamic load carrying capacity applies

Dynamically loaded crossed roller bearings, i.e. bearings that undergo predominantly rotary motion, are dimensioned in accordance with their dynamic load carrying capacity. The size of a dynamically loaded bearing can therefore be checked in approximate terms using the basic dynamic load ratings C and the basic rating life L or Lh.

Determining the basic rating life

The life formulae for L and L_h are only valid:

- with a load arrangement according to > 1153 \ \phi 12
- if all the requirements are fulfilled in relation to location (the bearing rings must be rigid or firmly connected to the adjacent construction), mounting, lubrication and sealing
- if the load and speed can be regarded as constant during operation. If the load and speed are not constant, equivalent operating values can be determined that will result in the same fatigue conditions as the actual loads
- if the load ratio is $F_r/F_a \le 8$.

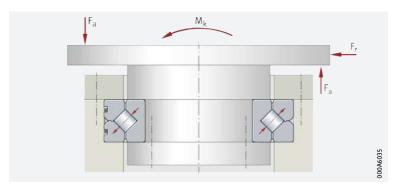
For more complex load arrangements, if a ratio $F_r/F_a > 8$ is present or there are variations from the specified conditions, please contact us.



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12 Load arrangement

F_a = axial dynamic bearing load F_r = radial dynamic bearing load $M_k = dynamic tilting moment load$



Determining the basic rating life for bearings subjected to combined loads

For bearings subjected to combined loads, in other words bearings with axial, radial and tilting moment loads, the rating life L or Lh is determined as follows:

- Determine the ratio of the radial dynamic bearing load F_r to the axial dynamic bearing load F_a (F_r/F_a)
- Calculate the load eccentricity parameter $\epsilon > 1153 \int 9$
- Using the values for ϵ and the ratio F_r/F_a , determine the dynamic load factor k_F ►1154 ⊕ 13
- Calculate the equivalent dynamic axial bearing load $P_a = k_F \cdot F_a$ ►1153 £ 10
- Enter the equivalent dynamic axial bearing load P_a and the basic dynamic axial load rating C_a in the rating life equations L or L_h respectively and calculate the rating life $\triangleright 1153$ £ 11 and ►1153 £12

If swivel operation is present, enter the operating speed n determined in the rating life equation $L_h > 1153 | f | 13$.

_f_l**9** Load eccentricity parameter

$$\epsilon = \frac{2000 \cdot M_k}{F_a \cdot D_M}$$

_f_1**10**

Equivalent dynamic axial bearing load

$$P_a = k_F \cdot F_a$$

_f_1**1**

Basic rating life in millions of revolutions

$$L_{10} = \left(\frac{C_a}{P_a}\right)^{r}$$

Basic rating life in operating hours

$$L_{10h} = \frac{16666}{n} \cdot \left(\frac{C_a}{P_a}\right)^p$$

Operating speed

$$d \quad n = n_{osc} \cdot \frac{\gamma}{90}$$

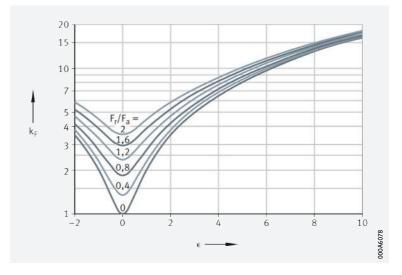
Dynamic load factor

k_F = dynamic load factor

 ϵ = load eccentricity parameter

 $F_a = axial dynamic bearing load$

 $F_r = radial dynamic bearing load$



Determining the basic rating life for bearings subjected to radial loads only

For slewing rings subjected to radial loads only, the following values are entered in the rating life formulae L and L_h :

- $P_r = F_r$
- the basic dynamic radial load rating C_r.

_f \dagged 144 Basic rating life in millions of revolutions

$$L_{10} = \left(\frac{C_r}{P_r}\right)^p$$

_f_l **15** Basic rating life in operating hours

$$L_{10h} = \frac{16666}{n} \cdot \left(\frac{C_r}{P_r}\right)$$

Legend

€	-	Load eccentricity parameter
M_k	kNm	Dynamic tilting moment load
F_a	kN	Axial dynamic bearing load
D_{M}	mm	Rolling element pitch circle diameter ►1168
P _a	kN	Equivalent dynamic axial bearing load. For bearings subjected to radial load only, enter P _r
k_F	-	Dynamic load factor ► 1154 🗁 13
L ₁₀	10 ⁶	Basic rating life in millions of revolutions
C _a , C _r	kN	Basic axial or radial dynamic load rating ►1168
p	-	Life exponent for crossed roller bearings: $p = 10/3$
L _{10h}	h	Basic rating life in operating hours
n	min ⁻¹	Operating speed
n _{osc}	min ⁻¹	Frequency of oscillating motion
γ	0	Half of swivel angle
P_r	kN	Equivalent dynamic radial bearing load
F _r	kN	Radial dynamic bearing load.

https://www.schaeffler.de/std/1D65

Given Crossed roller bearing

SX011820 Rolling element pitch circle diameter ➤ 1168 $D_M = 112 \text{ mm}$ $C_a = 28 \text{ kN}$ p = $10/_3$ Basic dynamic load rating (axial) ►1168 Life exponent for crossed roller bearings $F_a = 20 \text{ kN}$ Dynamic bearing load (axial) $F_r^{\alpha} = 4 \text{ kN}$ Dynamic bearing load (radial) $M_k = 1 \text{ kNm}$ Dynamic tilting moment load

Required Basic rating life L₁₀ in millions of revolutions

Solution

_f_1**16** Load eccentricity parameter

$$\epsilon = \frac{2000 \cdot M_{\rm p}}{F_{\rm a} \cdot D_{\rm M}}$$



$$\epsilon = \frac{2000 \cdot 1}{20 \cdot 112} = 0,89$$

$$\frac{F_r}{F_a} = \frac{4}{20} = 0.2$$

$$k_F = 2,1$$

Legend

€	-	Load eccentricity parameter
M_k	kNm	Dynamic tilting moment load
F_a	kN	Axial dynamic bearing load
D_{M}	mm	Rolling element pitch circle diameter ➤ 1168
F _r	kN	Radial dynamic bearing load
k_F	_	Dynamic load factor ► 1154 🔁 13.

Equivalent bearing load (static)



$P_a = 2,1.20 \text{ kN} = 42 \text{ kN}$

Legend

Pa	kN	Equivalent dynamic axial bearing load.
		For bearings subjected to radial load only, enter P _r
k_F	-	Dynamic load factor ➤ 1154 🗁 13
F_a	kN	Axial dynamic bearing load.

_f_1**8** Basic rating life in million revolutions

$$L_{10} = \left(\frac{C_a}{P_a}\right)^p$$



$$L_{10} = \left(\frac{28}{42}\right)^{\frac{10}{3}} = 0.26 \cdot 10^6 \text{ revolutions}$$

Legend

`		
L ₁₀	10 ⁶	Basic rating life in millions of revolutions
		For bearings subjected to radial load only, enter P _r
C_a, C_r	kN	Basic axial or radial dynamic load rating ➤ 1168
P_a	kN	Equivalent dynamic axial bearing load.
		For bearings subjected to radial load only, enter P _r
n	l –	Life exponent for crossed roller hearings: $p = \frac{10}{3}$.

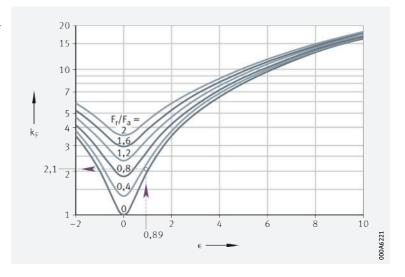
Dynamic load factor k_F for crossed roller bearings

 $k_F = dynamic load factor$

 ϵ = load eccentricity parameter

 $F_a = axial dynamic bearing load$

 F_r = radial dynamic bearing load



Determining the load carrying capacity of the fixing screws

In addition to the raceway, the load carrying capacity of the fixing screws must also be checked. This is based on the information in ≥ 1148 .

The load carrying capacity of the fixing screws can be checked if the following conditions are fulfilled:

- the criteria according to ➤ 1148
 - the screws are tightened as specified using a torque wrench screw tightening factor α_A = 1,6 tightening torques ►1161 | 8 to ►1162 | 9
- the permissible contact pressure is not exceeded
- screws of the recommended size, quantity and grade are used.

Indicator of load carrying capacity

The load carrying capacity of the screws is described by:

- the curves in the static limiting load diagrams for fixing screws in the product tables
- the maximum permissible radial load F_{r per} (friction locking).

The screw curves are shown in the static limiting load diagrams for fixing screws. The curves are based on screws of grade 10.9, tightened to 90% of their proof stress, including the torsion content.

If screws of grade 8.8 or 12.9 are used, the equivalent static loads F_{0q} and M_{0q} , \triangleright 1148, must be converted using the following factors:

- **grade** 8.8 $(F_{0q} \cdot 1,65, M_{0q} \cdot 1,65)$
- grade 12.9 (F_{0a}· 0,8, M_{0a}· 0,8).

https://www.schaeffler.de/std/1D65

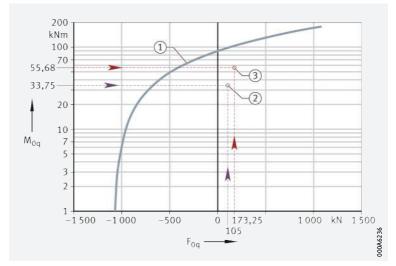
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 \bigcirc 15 Static limiting load diagram for fixing screws - example for crossed roller bearing SX011860

 $M_{0q} = equivalent \ tilting \ moment$ load (static)

F_{0q} = equivalent axial bearing load (static)

- 1) Screw curve
- (2) Load point for screws of normal grade (10.9)
- (3) Load point for screws of grade 8.8



Checking the static load carrying capacity of the screws

The static load carrying capacity of the screw is limited by its proof stress.

For applications with and without radial load

The equivalent static bearing loads F_{0q} and M_{0q} must be determined. Using the values F_{0q} and M_{0q} , the load point is then determined in the static limiting load diagram for fixing screws, see diagrams in product tables > 1170

The load point must be below the appropriate screw curve.

Radial load and static load carrying capacity of the screws

If radial loads occur in uncentred bearing rings, the screw connections must prevent displacement of the bearing rings on the adjacent construction.

In order to check this:

- multiply the radial bearing load by an application factor $f_A > 1150 \equiv 4$
- compare the values determined with the maximum permissible radial
- The maximum radial load $F_{r per}$ on the fixing screws is dependent on their friction locking and not on the radial load carrying capacity of the bearing. If the radial load on the bearing is higher than the friction locking of the fixing screws or very high radial loads are present $(F_r/F_a > 4)$, please contact us.

Checking the dynamic load carrying capacity of the screws

The dynamic load carrying capacity of the screws corresponds to the fatigue strength of the screw.

Dynamic load carrying capacity

Based on the dynamic loads present, the equivalent loads F_{0q} and M_{0q} are determined.

Instead of the application factor f_A, the operating load must always be increased by the following factor:

■ grade 8.8 (factor 1,8), grade 10.9 (factor 1,6), grade 12.9 (factor 1,5).

The load carrying capacity must then be checked in the static limiting load diagram for the fixing screws ≥ 1168

The load point must be below the appropriate screw curve.



1.15

Minimum load

In order that no slippage occurs between the contact partners, the crossed roller bearings must be constantly subjected to a sufficiently high load. In most cases, however, the load is already sufficiently high due to the weight of the supported parts and the external forces.

1.16

Design of bearing arrangements

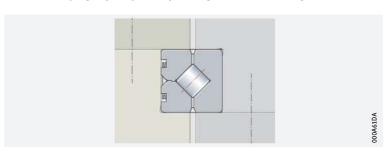
The design of the adjacent construction has a considerable influence on the function of the bearings

Crossed roller bearings SX can support high loads. Due to the X arrangement of the cylindrical rollers, these bearings can support axial forces in both directions, radial loads, tilting moment loads and any combinations of loads. In order that these advantages can be utilised comprehensively, the adjacent construction must be designed so that it is appropriately rigid. The bearing rings must always be rigidly and uniformly supported over the circumference and width of the rings > 1158 \bigcirc 16.



The adjacent construction must be designed only in accordance with the information in this section. Any deviations from the specifications, material strength and adjacent components will considerably reduce the load carrying capacity and operating life of the bearings.

Uniform support of the bearing rings by the adjacent construction



Shaft and housing tolerances

For normal applications, the tolerance class K7 e for the housing and h7 e for the shaft are sufficient $\triangleright 1158 | \boxplus 5$ and $\triangleright 1159 | \boxplus 6$.

In precision applications, the bearing seat in the housing should be designed to tolerance class K6 e and on the shaft to h6 $\textcircled{e} > 1158 | \boxplus 5$ and $> 1159 | \boxplus 6$.



Nominal dimension d_i mm		Tolerance classes						
>	≦	h6		h7				
		Upper deviation	Lower deviation	Upper deviation	Lower deviation			
		μm μm		μm	μm			
65	80	0	-19	0	-30			
80	100	0	-22	0	-35			
100	120	0	-22	0	-35			
120	140	0	-25	0	-40			
140	160	0	-25	0	-40			
160	180	0	-25	0	-40			
	continued ▼							

https://www.schaeffler.de/std/1D65

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Nominal dimension d _i		Tolerance classes						
>	≦	h6		h7				
				Upper deviation	Lower deviation			
		μm	μm	μm	μm			
180	200	0	-29	0	-46			
200	225	0	-29	0	-46			
225	250	0	-29	0	-46			
250	280	0	-32	0	-52			
280	315	0	-32	0	-52			
315	355	0	-36	0	-57			
355	400	0	-36	0	-57			
400	450	0	-40	0	-63			
450	500	0	0 -40		-63			
	continued 🛦							



Nominal dimension $\mathbf{D}_{\mathbf{a}}$ mm		Tolerance classes					
>	≦	K6	K6 K		K7		
		Upper deviation	Lower deviation	Upper deviation	Lower deviation		
		μm	μm	μm	μm		
80	100	+4	-18	+10	-25		
100	120	+4	-18	+10	-25		
120	140	+4	-21	+12	-28		
140	160	+4 -21		+12	-28		
160	180	+4 -21		+12	-28		
180	200	+5	-24	+13	-33		
200	225	+5	-24	+13	-33		
225	250	+5	-24	+13	-33		
250	280	+5	-27	+16	-36		
280	315	+5	-27	+16	-36		
315	355	+7	-29	+17	-40		
355	400	+7	-29	+17	-40		
400	450	+8	-32	+18	-45		
450	500	+8	-32	+18	-45		
500	560	0	-44	0	-70		
560	630	0	-44	0	-70		

Location using clamping rings

For the location of crossed roller bearings SX, clamping rings have proved effective $\triangleright 1161 \bigcirc 17$.



The bearing rings must always be rigidly and uniformly supported over the circumference and width of the rings.

The thickness of the clamping rings and mounting flanges must not be less than the minimum thickness ${\bf s}$.

Counterbores to DIN 74, type J, for screws to DIN 6912 are permissible. For deeper counterbores, the thickness of the clamping ring s must be increased by the additional counterbore depth.

Mounting dimensions $> 1160 | \boxplus 7$ and $> 1161 | \bigoplus 17$. Minimum strength of clamping rings > 1160.

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Bearing seat depth

In order that the clamping rings retain the bearing securely, the bearing seat depth t must be in accordance with the specification $\triangleright 1160 | \boxplus 7$ and $\triangleright 1161 | \bigoplus 17$.



The depth of the bearing seat influences the bearing clearance and the rotational resistance.

Bearings with preload (suffix VSP) have a considerably higher rotational resistance.

If particular requirements for rotational resistance apply, the depth t must be produced to match the relevant height of the bearing ring. It has proved effective to tolerance the depth t to deviations that are the same as or further restricted compared to the dimension h in the product tables. For safety, internal tests should in any case be carried out.

Minimum strength of clamping rings

For screws of grade 10.9, the minimum strength under the screw heads or nuts must be 500 N/mm^2 . Seating washers are not necessary for these screws.

For fixing screws of grade 12.9, the minimum strength must not be less than 850 N/mm², otherwise quenched and tempered seating washers under the screw heads or quenched and tempered nuts must be used.

Ⅲ 7Mounting dimensions

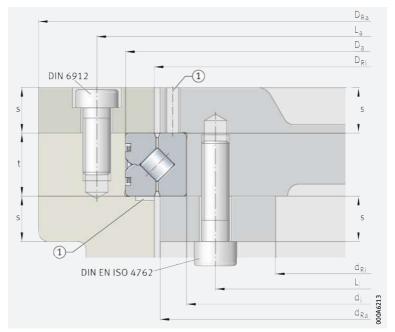
Designation	Mounting dimensions in mm									
	d _i h7	D _a K7	t	S	d _{Ra}	d _{Ri}	D _{Ri}	D _{Ra}	Li	La
	(h6)	(K6)		min.					max.	min.
SX011814	70	90	10 -0,005 -0,015	8	78	42	82	118	60	100
SX011818	90	115	13 -0,005 -0,020	10	100	61	104	144	80	125
SX011820	100	125	13 -0,005 -0,020	10	110	71	114	154	90	135
SX011824	120	150	16 -0,005 -0,025	12	132	84	138	186	108	162
SX011828	140	175	18 -0,005 -0,030	14	154	94	160	221	124	191
SX011832	160	200	20 -0,02 -0,05	15	177	111	183	249	144	216
SX011836	180	225	22 -0,02 -0,05	17	199	121	205	284	160	245
SX011840	200	250	24 -0,02 -0,06	18	221	139	229	311	180	270
SX011848	240	300	28 -0,02 -0,06	21	269	166	274	374	216	324
SX011860	300	380	38 -0,04 -0,10	29	335	201	345	479	268	412
SX011868	340	420	38 -0,04 -0,10	29	375	241	385	519	308	452
SX011880	400	500	46 -0,04 -0,10	35	445	275	455	625	360	540
SX0118/500	500	620	56 -0,04 -0,10	42	554	350	566	700	452	668

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Clamping rings, bearing seat depth, mounting dimensions

 Slots, threaded extraction hole or similar for dismounting purposes





Fixing screws

For the location of the bearing rings or clamping rings, screws of grade 10.9 are suitable $> 1161 \mid \boxplus 8$.



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.



Crossed roller bearings	Fixing screws Grade 10.9	Tightening torque	
	Dimension	Quantity	M _A Nm
SX011814	M5	18	7
SX011818	M5	24	7
SX011820	M5	24	7
SX011824	M6	24	11,7
SX011828	M8	24	27,8
SX011832	M8	24	27,8
SX011836	M10	24	55,6
SX011840	M10	24	55,6
SX011848	M12	24	98,4
SX011860	M16	24	247
SX011868	M16	24	247
SX011880	M20	24	481
SX0118/500	M24	24	831

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Securing of screws

Normally, the screws are adequately secured by the correct preload $ightharpoonup 1162 | \boxplus 9$ and $ightharpoonup 1162 | \boxplus 10$. 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 25201-4:2004. If these are to be used, please consult the relevant companies.

Tightening torques M_A for the torque-controlled tightening of socket headless

Fixing screw	Clamping cross-section	Core cross-section	Tightening torque M _A ¹⁾ in Nm for grade		
	A _S mm ²	A _{d3} mm ²	8.8	10.9	12.9
M4	8,78	7,75	2,25	3,31	3,87
M5	14,2	12,7	4,61	6,77	7,92
M6	20,1	17,9	7,8	11,5	13,4
M8	36,6	32,8	19,1	28	32,8
M10	58	52,3	38	55,8	65,3
M12	84,3	76,2	66,5	97,7	114
M14	115	105	107	156	183
M16	157	144	168	246	288
M18	192	175	229	336	394
M20	245	225	327	481	562
M22	303	282	450	661	773
M24	353	324	565	830	972

 $^{^{1)}}$ M_A in accordance with guideline VDI 2230 (February 2003) for μ_K = 0,08 and μ_G = 0,12.

Assembly preload forces F_M for the torque-controlled tightening of socket headless screws

Fixing screw	Clamping cross-section	Core cross-section	Mounting preload force F _M ¹⁾ in kN for grade						
	A _S mm ²	A _{d3} mm ²	8.8	10.9	12.9				
M4	8,78	7,75	4,05	5,95	6,96				
M5	14,2	12,7	6,63	9,74	11,4				
M6	20,1	17,9	9,36	13,7	16,1				
M8	36,6	32,8	17,2	25,2	29,5				
M10	58	52,3	27,3	40,2	47				
M12	84,3	76,2	39,9	58,5	68,5				
M14	115	105	54,7	80,4	94,1				
M16	157	144	75,3	111	129				
M18	192	175	91,6	134	157				
M20	245	225	118	173	202				
M22	303	282	147	216	253				
M24	353	324	169	249	291				

 $^{^{1)}}$ F_{M} in accordance with guideline VDI 2230 (February 2003) for μ_{G} = 0,12.

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1.17 Mounting and dismounting

Mounting of crossed roller bearings

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 seat surfaces can rust or the raceway system can become contaminated.

Mounting forces must only be applied to the bearing ring to be mounted; forces must never be directed through the rolling elements or seals. Avoid direct blows on the bearing rings in all cases.

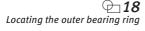
Locate the bearing rings consecutively and without application of any external load.

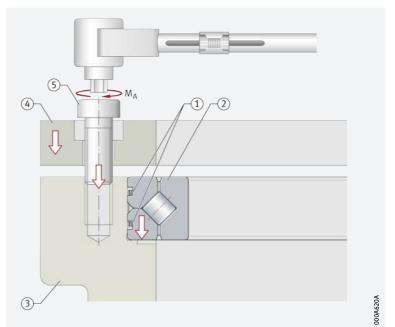
The outer ring is split and is held together by three retaining rings (1) ► 1163 🗁 18. Never apply tensile loads to the retaining rings.

Locating the outer bearing ring

Mounting of the ring $\triangleright 1163$ \bigcirc 18:

- Insert or press the bearing ② into the external adjacent construction ③ with the outer ring first
- Position the external clamping ring ④
- Insert the fixing screws (5) in the clamping ring and tighten in steps up to the specified tightening torque MA
 - tighten the screws in a crosswise sequence in order to prevent unacceptable fluctuations in the screw tensioning forces
 - tightening torques M_A for fixing screws ≥ 1162 $\parallel = 9$.







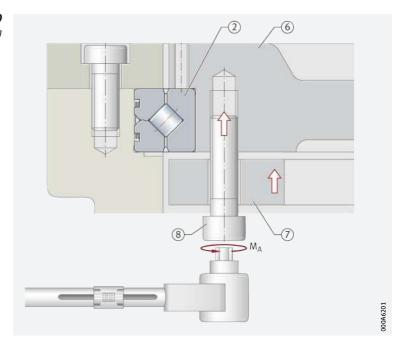
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Locating the inner bearing ring

Mounting of the ring $\triangleright 1164 \bigcirc 19$:

- Insert the bearing ② into the internal adjacent construction ⑥
- Position the internal clamping ring (7)
- Insert the fixing screws (8) in the clamping ring and tighten in steps up to the specified tightening torque M_A
 - tighten the screws in a crosswise sequence in order to prevent unacceptable fluctuations in the screw tensioning forces.

 \bigcirc **19** Locating the inner bearing ring



Checking the function



Once mounting is complete, the operation of the mounted crossed roller bearing must be checked. If the bearing runs irregularly or roughly, or the temperature in the bearing shows an unusual increase, the bearing must be dismounted, checked and mounted again in accordance with the mounting guidelines described.

Checking the running accuracy

Possible causes of deviations in values

The running accuracy must be checked by means of a dial gauge. The corresponding values are taken from the mounting drawing or the product tables. Deviations from the values may be the result of:

- inaccuracies in the adjacent construction
- braced bearings due to incorrectly tightened clamping rings, fixing screws or locknuts.

Checking the rotational resistance

© Factors influencing the rotational resistance

The rotational resistance is essentially determined by:

- the rolling resistance of the rolling elements
- the internal clearance or bearing preload
- the friction of the spacers
- the friction of the seals
- the grease
- a deformed or defective adjacent construction
- errors during mounting.

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© Preload, rotational resistance, bearing temperature

Due to the preload in the rolling element system, the rotational resistance is higher than in a bearing with clearance. At higher speeds, a high preload can lead to generation of significant heat in the bearing. In such applications, tests must be carried out if necessary with bearings preloaded to various values.

Checking the bearing temperature

Possible causes of high temperatures

After commissioning, the temperature in the bearing can increase; in the case of grease lubrication, this may continue until the grease is evenly distributed in the bearing. A further increase or unusually high temperatures may be caused by one of the following:

- The bearing is lubricated using an unsuitable grease
- There is too much lubricant in the bearing
- The bearing load is too high
- The bearing is mounted unevenly
- The adjacent construction deviates from the specifications.

Schaeffler Mounting Handbook

Rolling bearings must be handled with great care Rolling bearings are well-proven precision machine elements for the design of economical and reliable bearing arrangements, which offer high operational security. In order that these products can function correctly and achieve the envisaged operating life without detrimental effect, they must be handled with care.



The Schaeffler Mounting Handbook MH 1 gives comprehensive information about the correct storage, mounting, dismounting and maintenance of rotary rolling bearings > https://www.schaeffler.de/std/1D53. It also provides information which should be observed by the designer, in relation to the mounting, dismounting and maintenance of bearings, in the original design of the bearing position. This book is available from Schaeffler on request.



1.18 Legal notice regarding data freshness

 The further development of products may also result *in technical changes* to catalogue products

Of central interest to Schaeffler is the further development and optimisation of its products and the satisfaction of its customers. In order that you, as the customer, can keep yourself optimally informed about the progress that is being made here and with regard to the current technical status of the products, we publish any product changes which differ from the printed version in our electronic product catalogue.



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Link to electronic product catalogue



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19 Further information



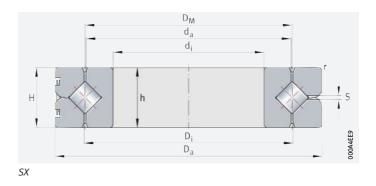
In addition to the data in this chapter, the following chapters in Technical principles must also be observed in the design of bearing arrangements:

- Determining the bearing size ➤ 34
- Rigidity ➤ 54
- Friction and increases in temperature > 56
- Speeds ►64
- Bearing data ➤ 97
- Lubrication ➤ 70
- Sealing ➤ 182
- Design of bearing arrangements ➤ 139
- Mounting and dismounting > 191.

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Crossed roller bearings

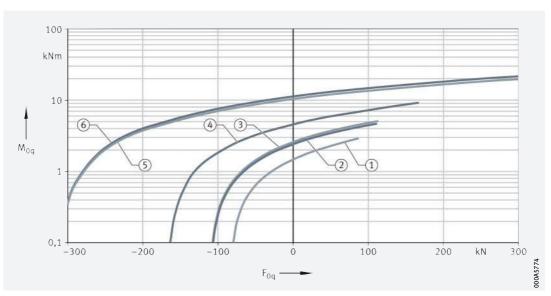


$d_i = 70 - 160 \text{ mm}$

Main dimensions				load	rating	S	Limitir	ng speed	ls		Mass	Designation	identical ve 618
d _i	D _a	H ¹⁾	axial		radia	[2)	with st	tandard nce	with preloa	d	m	➤ 1147 1.12 ➤ 1147 1.13	Dimensions iden to deep groove ball bearing 618
			dyn. C _a	stat. C _{0a}	dyn. C _r	stat. C _{0r}	n _G oil	n _G grease	n _G oil	n _G grease			nensio deep g L beari
K6	h6		kN	kN	kN	kN	min ⁻¹	min ⁻¹	min ⁻¹	min ⁻¹	≈ kg		Din to c bal
70 +0,004 -0,015		10 +0,06 -0,06	16,6	52	11,8	25,5	1910	955	955	475	0,3	SX011814	61814
90 +0,004 -0,018		13 +0,06 -0,06	26,5	87	18,9	43	1 500	750	750	375	0,4	SX011818	61818
100 +0,004 -0,018		13 +0,06 -0,06	28	97	20	47,5	1 360	680	680	340	0,5	SX011820	61820
120 +0,004 -0,018		16 +0,06 -0,06	39,5	140	28	69	1130	565	565	280	0,8	SX011824	61824
140 +0,004 -0,021		18 +0,06 -0,06	64	223	45,5	109	975	485	485	240	1,1	SX011828	61828
160 +0,004 -0,021		20 +0,10 -0,10	69	255	49	126	850	425	425	210	1,7	SX011832	61832

medias ➤ https://www.schaeffler.de/std/1E26

²⁾ Basic load ratings, radial: for radial loads only.

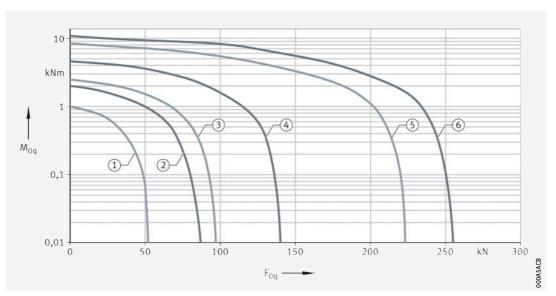


Static limiting load diagrams for fixing screws – compressive load

¹⁾ $\overline{H} = \text{section height of bearing, h} = \text{height of individual ring.}$

https://www.schaeffler.de/std/1D65

Dime	ensio	ns					Runnir	0	Norma	l cleara	nce		Low clear- ance RLO		Preload VSP																				
d _i	D _M	h ¹⁾	d _a	D _i	r	S	radial	axial	Radial clearance												axial Radial clearance								Axial ti cleara	_	Radial clear- ance	Pre- load			Position: see diagram
					min.				min.	max.	min.	max.	max.	max.	min.	max.	Pos																		
70	80	10 0 -0,01	79,5	80,5	0,6	1,2	0,01	0,01	0,003	0,015	0,006	0,03	0,003	0,006	0,003	0,015	1																		
90	102	13 0 -0,01	101,5	102,5	1	1,2	0,01	0,01	0,003	0,015	0,006	0,03	0,003	0,006	0,003	0,015	2																		
100	112	13 0 -0,01	111,5	112,5	1	1,2	0,01	0,01	0,005	0,02	0,01	0,04	0,004	0,008	0,005	0,02	3																		
120	135	16 0 -0,01	134,4	135,6	1	1,5	0,01	0,01	0,005	0,02	0,01	0,04	0,004	0,008	0,005	0,02	4																		
140	157	18 0 -0,01	156,3	157,7	1,1	1,5	0,015	0,01	0,005	0,02	0,01	0,04	0,004	0,008	0,005	0,02	5																		
160	180	20 0 -0,025	179,2	180,8	1,1	1,5	0,015	0,01	0,005	0,02	0,01	0,04	0,004	0,008	0,005	0,02	6																		

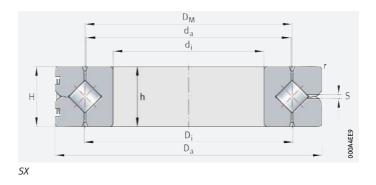


Static limiting load diagrams for raceway – compressive load

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Crossed roller bearings

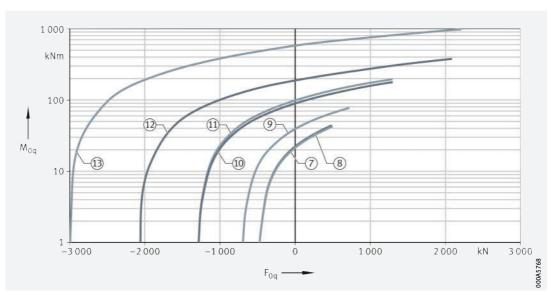


$d_i = 180 - 500 \text{ mm}$

Main dimensions				c load ı	rating	(S	Limiti	ng speed	ls		Mass	Designation	identical ve 618
d _i	d _i D _a		axia	axial		al ²⁾	with standard clearance		with preload		m	➤1147 1.12 ➤1147 1.13	ns iden roove ng 618
			dyn. C _a	stat. C _{0a}	dyn. C _r	stat. C _{Or}	n _G oil	n _G grease	n _G oil	n _G grease			Dimensions ider to deep groove ball bearing 618
K6	h6		kN	kN	kN	kN	min ⁻¹	min ⁻¹	min ⁻¹	min ⁻¹	≈ kg		Din to ba
180 +0,004 -0,021		22 +0,10 -0,10	98	360	70	177	755	375	375	185	2,3	SX011836	61836
200 +0,004 -0,024		24 +0,10 -0,10	104	400	74	197	680	340	340	170	3,1	SX011840	61840
240 +0,005 -0,024		28 +0,10 -0,10	149	600	106	295	565	280	280	140	5,3	SX011848	61848
300 +0,005 -0,027		38 +0,14 -0,14	245	990	174	485	450	225	225	110	12	SX011860	61860
340 +0,007 -0,029		38 +0,14 -0,14	265	1130	187	550	400	200	200	100	13,5	SX011868	61868
400 +0,007 -0,029		46 +0,15 -0,15	385	1 660	275	810	340	170	170	85	24	SX011880	61880
500 +0,008 -0,032		56 +0,16 -0,16	560	2 5 5 0	395	1 250	275	135	135	65	44	SX0118/500	618/500

medias ➤ https://www.schaeffler.de/std/1E27

²⁾ Basic load ratings, radial: for radial loads only.

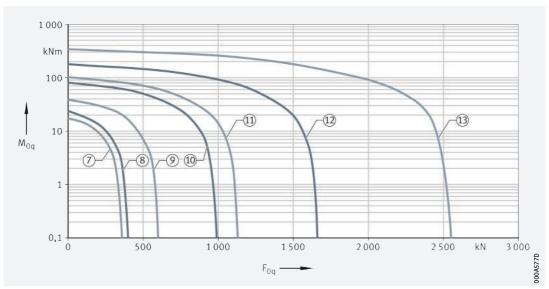


Static limiting load diagrams for fixing screws – compressive load

 $^{^{1)}}$ H = section height of bearing, h = height of individual ring.

Dime	ensio	ns					Running accuracy		Normal clearance				Low clear- ance RLO		Preload VSP					
d _i	D _M	h ¹⁾	d _a	D _i	r	S	radial	clearance tilting						earance tilting		Radial clear- ance	Pre- load			Position: see diagram
					min.				min.	max.	min.	max.	max.	max.	min.	max.	Pos			
180	202	22 0 -0,025	201,2	202,8	1,1	2	0,015	0,01	0,005	0,025	0,01	0,05	0,005	0,01	0,005	0,025	7			
200	225	24 0 -0,025	224,2	225,8	1,5	2	0,015	0,01	0,005	0,025	0,01	0,05	0,005	0,01	0,005	0,025	8			
240	270	28 0 -0,025	269,2	270,8	2	2	0,02	0,01	0,01	0,03	0,02	0,06	0,005	0,01	0,005	0,025	9			
300	340	38 0 -0,05	339,2	340,8	2,1	2,5	0,02	0,01	0,01	0,04	0,02	0,08	0,005	0,01	0,005	0,025	10			
340	380	38 0 -0,05	379,2	380,8	2,1	2,5	0,025	0,01	0,01	0,04	0,02	0,08	0,005	0,01	0,005	0,025	11)			
400	450	46 0 -0,05	449	451	2,1	2,5	0,03	0,01	0,01	0,05	0,02	0,1	0,005	0,01	0,005	0,025	12			
 500	560	56 0 -0,05	558,8	561,2	3	2,5	0,04	0,01	0,015	0,06	0,03	0,12	0,006	0,012	0,005	0,03	13			





 $Static\ limiting\ load\ diagrams\ for\ raceway-compressive\ load$

https://www.schaeffler.de/std/1D65