FAG

Toroidal Roller Bearings TORB

Longer rating life and operating life – higher technical and economic performance

SCHAEFFLER

Foreword

Schaeffler Technologies

Schaeffler Technologies with its brands INA and FAG is a leading worldwide supplier of rolling bearings, spherical plain bearings, plain bearings, linear products, accessories specific to bearings and comprehensive maintenance products and services.
It has approximately 40 000 catalogue products manufactured as standard, providing an extremely wide portfolio that gives secure coverage of applications from all 60 industrial market sectors.

The central factors responsible for this success are our outstanding strength in innovation, our global focus on local customer proximity, highly developed manufacturing methods, extremely high quality standards in all processes and our ability to transform specific customer requirements quickly and accurately into cost-effective solutions. Against this background of expertise, knowledge and experience together with our wide range of catalogue items, we see ourselves as a high performance, customer focussed partner.

TORB – what is it?

The toroidal roller bearing TORB is a new type of rolling bearing from Schaeffler. It is a single row rolling bearing with long, slightly crowned rollers. When used as a non-locating bearing, it combines the self-alignment function of a spherical roller bearing with the axial displacement facility of a cylindrical roller bearing.

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Toroidal roller bearings

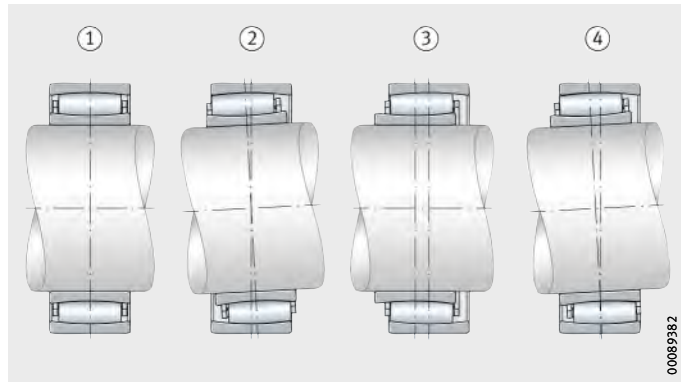
Features

FAG toroidal roller bearings are single row bearings with long, crowned rollers. The concave raceways in the inner ring and outer ring are concentric relative to the centre of the bearing. The raceway profiles are matched to each other and ensure optimum distribution of stresses in the bearing as well as low operating friction.

The rollers are self-guiding. They will always automatically adopt the position at which the load is distributed over the length of the roller. This is also the case if the rings are displaced or skewed relative to each other, *Figure 1*.

The toroidal roller bearing combines the angular adjustment facility of a spherical roller bearing with the unconstrained axial displacement facility of a cylindrical roller bearing. It offers a very high radial load carrying capacity within a small design envelope.

Toroidal roller bearings offer an ideal and operationally reliable solution to the problem of achieving a locating/non-locating bearing. Since axial displacement is compensated within the toroidal roller bearing, the constraining forces occurring are very slight and can be disregarded.



① Initial position
② Inner ring with tilting
③ Inner ring with axial displacement
④ Inner ring with displacement and tilting

Figure 1
Toroidal roller bearing
(tilting and axial displacement)

A particularly high load carrying capacity is available in the full complement design, indicated by the suffix V, *Figure 2*.
Full complement toroidal roller bearings are intended for applications such as continuous casting lines.

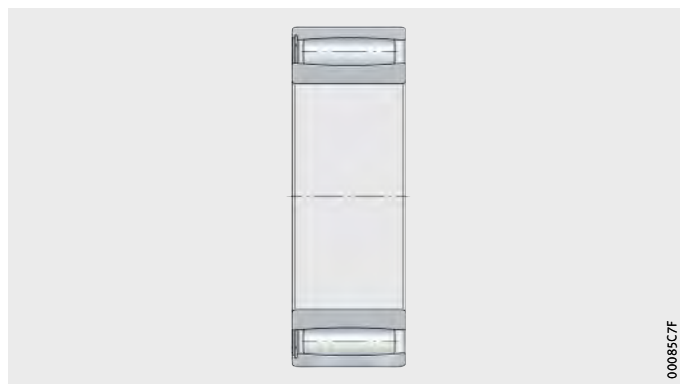


Figure 2
Full complement
toroidal roller bearing

X-life is the premium brand that identifies particularly high performance products under the FAG and INA brands.
They are characterised by a long rating life and operating life, due to the use of the most modern manufacturing techniques, *Figure 3*.

They lead to better and more uniform surfaces and contact areas and thus optimised load distribution in the bearing.

This opens up expanded design possibilities:

- Under the same load and with an unchanged design envelope, X-life bearings have a longer rating life and maintenance intervals can be extended.
- Conversely, an X-life bearing in the same design envelope and with the same rating life can support higher loads.
- Where the rating life and load remain unchanged, X-life bearings allow higher performance density, facilitating optimisation of the design envelope and reductions in mass.

As a result, the X-life bearing makes a significant contribution to improved overall cost-efficiency under the philosophy of Total Cost of Ownership (TCO).

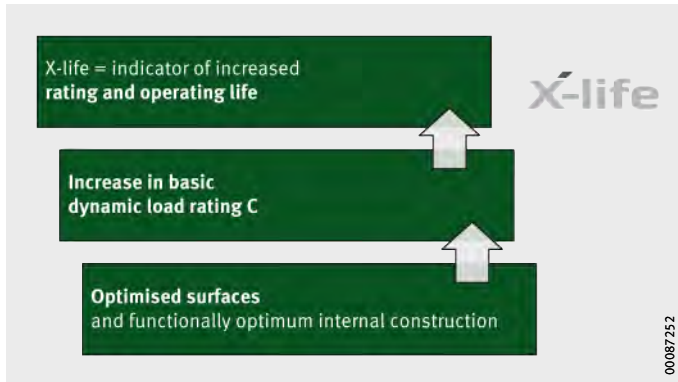


Figure 3
Key characteristics of X-life

Toroidal roller bearings

The ideal non-locating bearing concept

Where a shaft is liable to temperature-induced elongation and misalignment defects, the non-locating bearing is a particularly important concept. In this case, toroidal roller bearings have proved ideal as non-locating bearings, *Figure 4*.

In comparison with normal non-locating bearing arrangements, they offer significant advantages:

- Substantial changes in shaft length are compensated without constraint between the raceways and the rolling elements within the bearing.
- Even more considerable axial displacements have no effect on the locating bearing.
- There is no axial distortion of the bearing system.

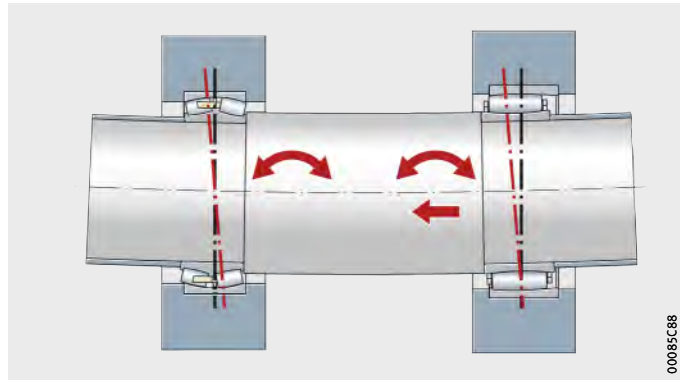


Figure 4
The ideal non-locating bearing concept

Principal areas of application

The principal areas of application of toroidal roller bearings are:

- steelworks and rolling mills
- conveying equipment and belt installations
- paper machinery
- continuous flow machines
- crushers
- gearboxes
- textile machinery
- machinery for food processing
- agricultural equipment.

Requirements

The requirements placed on the bearings are:

- constraint-free non-locating bearing function
- high load carrying capacity
- high operational reliability
- long operating life
- low maintenance outlay
- low operating costs
- compact construction
- high performance capability.

Operating temperature

Toroidal roller bearings are dimensionally stable up to +200 °C. Bearings with metal cages can be used at operating temperatures from –30 °C to +200 °C.

Lubrication

Open toroidal roller bearings can be lubricated with oil or grease. Lubricant is introduced from one side and exits on the opposing side.

Cages

Toroidal roller bearings are essentially available in two designs:

- full complement
- bearing with cage.

Full complement bearings have a higher load carrying capacity than the variant with a cage.

Depending on the series and bearing size, toroidal roller bearings are supplied as standard with the following cage designs:

- roller-guided sheet steel cage, single-piece, no suffix
- roller-guided brass window cage, suffix M
- brass window cage, guided on inner ring, suffix M1B.

Suffix

Available designs

Suffixes	Description
XL	X-life quality
K	Tapered bore, taper ratio 1:12
K30	Tapered bore, taper ratio 1:30
C2	Radial internal clearance C2/Group N (smaller than normal)
C3	Radial internal clearance C3/Group 3 (larger than normal)
C4	Radial internal clearance C4/Group 4 (larger than normal C3)
C5	Radial internal clearance C5 (larger than C4)
V	Full complement cylindrical roller set
M	Brass window cage, guided by rollers
M1B	Brass window cage, guided on inner ring
W209B	Inner ring made from case hardening steel
H262A	Full complement TORB without retaining ring

Toroidal roller bearings

Product range

The range of FAG toroidal roller bearings comprises eight series, *Figure 5*.

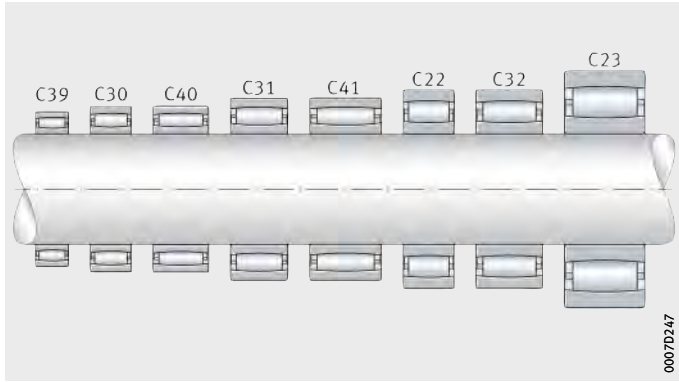


Figure 5
Product range

Interchangeability

Full interchangeability of the bearings is assured, since toroidal roller bearings are manufactured as standard in the same ISO dimension series and sizes as, for example, spherical roller bearings.

Bearing housings

Through the combination of a toroidal roller bearing and FAG bearing housing, it is possible to create non-locating bearing arrangement units that are interchangeable and operationally reliable. As a result, economical and maintenance-friendly designs can be achieved, *Figure 6*.

Figure 6
Bearing housing
with toroidal roller bearing

Products for mounting, maintenance and monitoring

In order to ensure that the high performance capability of FAG toroidal roller bearings can be exploited to the full, particular attention must be paid to their particular characteristics in terms of mounting and dismounting, lubrication, sealing and maintenance, *Figure 7*.

The methods to be used in mounting and dismounting are comprehensively described in publication MH 1, Mounting of Rolling Bearings. In those cases where a production stoppage can incur heavy costs, monitoring of rolling bearings is both advisable and cost-effective. An overview of suitable tools, measuring devices and diagnostic equipment can be found in Catalogue IS 1, Mounting and Maintenance of Rolling Bearings.

Figure 7
Mounting of toroidal roller bearing

Design and safety guidelines

Permissible skewing

Toroidal roller bearings can be tilted by an angle of up to 0,5° between the centre axes of the inner ring and outer ring without impairment of the function and rating life. In this way, the toroidal roller bearing can compensate a slight geometrical deviation of the housing bore or a shaft that is not precisely aligned without difficulty.

Depending on the series and size, skewing of more than 0,5° is possible but may be associated with a reduction in the rating life. In the case of such applications, please contact our technical advisory service in order to achieve an optimum design of the bearing arrangement.

Axial displacement facility

Toroidal roller bearings can accommodate axial offset and thus compensate thermal expansion or deviations from the required bearing position. The part-specific displacement distance s_1 is the maximum possible displacement on both sides, relative to the central position. In the case of full complement bearings, the displacement distance s_2 is restricted on one side by the retaining ring. The displacement distances s_1 and s_2 are only valid for a sufficiently large operating clearance and untilted bearing rings. Axial displacement and tilting changes the position of the rolling element in the bearing, which changes the operating clearance.

During the design process, it must always be checked whether the operating clearance required will be present if there is:

- axial displacement
- tilting
- axial displacement and tilting.

In order to ensure that the axial displacement distance is available, it is necessary that the free space on both sides of the bearing is observed, see page 21.

In order to ensure the function of the toroidal roller bearings, two different situations must be checked. On the one hand, it must be checked whether the axial displacement distance in combination with the tilting is still within the permitted displacement distance s_1 or s_2 respectively. Since axial displacement and tilting affect the bearing clearance, it must also be checked whether sufficient operating clearance will be present in the application.

For bearings with the M1B cage, the following must be observed: In the range of maximum axial displacement (at or above 90% of s_1), a load ratio Lastverhältnis $C_0/P > 5$ must not be exceeded. In the case of values exceeding this range, please contact the technical advisory service of Schaeffler.

The resulting bearing clearance can be determined using the following equation:

$$s_{res} = s_{ini} - \Delta s$$

$$\Delta s = k_{\delta} \cdot \left(\delta_{ax} + s_{\varphi}\right)^2$$

$$s_{\varphi} = k_{\varphi} \cdot \varphi$$

$$s_{res} = s_{ini} - k_{\delta} \cdot \left(\delta_{ax} + k_{\varphi} \cdot \varphi\right)^2$$

s_{res} µm
Resulting bearing clearance after tilting and axial displacement

s_{ini} µm
Radial internal clearance after mounting

Δs µm
Reduction in radial bearing clearance

k_{δ} –
Operating clearance factor, see dimension table

δ_{ax} mm
Axial displacement from central position

s_{φ} mm
Reduction in axial displacement facility as a result of tilting

k_{φ} –
Tilting factor, see dimension table

φ °
Tilting between inner ring and outer ring (misalignment ± shaft deflection).

Other influences such as differences in temperature between the inner ring and outer ring must also be taken into consideration.

The individual influences are described in detail below.

Geometrical restriction of the axial displacement facility

Tilting causes axial displacement of the rollers from the central position. This means that the axial displacement facility of the bearing rings relative to each other is reduced by s_φ.

This reduction in the axial displacement facility due to tilting can be calculated as follows:

$$s_\varphi = k_\varphi \cdot \varphi$$

s_φ mm
Reduction in axial displacement facility as a result of tilting
k_φ –
Tilting factor, see dimension table
φ °
Tilting between inner ring and outer ring (misalignment ± shaft deflection).

When tilting occurs at the same time, the maximum possible axial displacement facility is calculated as follows:

$$s_{red} = s_1 - s_\varphi$$

In the case of full complement bearings, there is an additional effect as follows:

$$s_{red} = s_2 - s_\varphi$$

s_{red} mm
Maximum axial displacement facility under tilting
s_1 mm
Maximum axial displacement facility from dimension table,
in the case of full complement bearings in the opposing direction
to the retaining ring
s_φ mm
Reduction in axial displacement facility as a result of tilting
s_2 mm
Maximum axial displacement facility from dimension table,
in the case of full complement bearings in the direction of the retaining ring.

Restriction due to reduction in radial bearing clearance

The bearing clearance is reduced in the following cases:

- axial displacement
- tilting of the bearing from the central position
- axial displacement and tilting of the bearing from the central position.

Depending on the necessary operating clearance, it must be checked whether the required axial displacement is possible under the tilting present.

The reduction in operating clearance is calculated as follows:

$$\Delta s = k_{\delta} \cdot \left(\delta_{ax} + k_{\varphi} \cdot \varphi\right)^2$$

Δs μm
Reduction in radial bearing clearance

k_{δ} –
Operating clearance factor, see dimension table

δ_{ax} mm
Axial displacement

k_{φ} –
Tilting factor, see dimension table

φ °
Tilting between inner ring and outer ring (misalignment ± shaft deflection).

Example 1 The toroidal roller bearing C3144-XL-K-C4 with a tapered bore is supplied with an internal clearance of 410 µm, where the operating clearance in the central position is only 240 µm due to mounting.

Application:
In the dryer roll, the misalignment is 0,2° and the shaft also undergoes thermal elongation of 6,3 mm.
Is this displacement permissible in addition to the tilting?
What is the change in the operating clearance?

k_φ = 13,67, see dimension table
φ = 0,2
s_1 = 22,3, see dimension table

$$s_\varphi = k_\varphi \cdot \varphi$$

$$s_\varphi = 13{,}67 \cdot 0{,}2 \approx 2{,}73 \text{ mm}$$

s_φ mm
Reduction in axial displacement facility as a result of tilting
k_φ –
Tilting factor, see dimension table
φ °
Tilting between inner ring and outer ring (misalignment ± shaft deflection).

$$s_{red} = s_1 - s_\varphi$$

$$s_{red} = 22{,}30 \text{ mm} - 2{,}73 \text{ mm} = 19{,}57 \text{ mm}$$

The axial displacement by 6,3 mm is in the permissible range of 19,57 mm in combination with tilting by 0,2°. The application must now be checked in relation to the reduction in operating clearance.

k_δ = 0,791, see dimension table
δ_{ax} = 6,30 mm

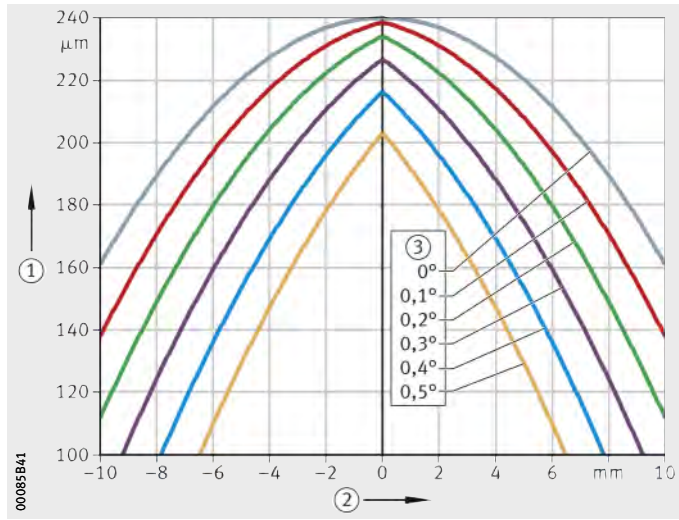
$$s_{res} = s_{ini} - k_\delta \cdot \left(\delta_{ax} + k_\varphi \cdot \varphi\right)^2$$

$$s_{res} = 240\ \mu\text{m} - 0{,}791 \cdot \left(6{,}3 + 2{,}73\right)^2 \approx 175\ \mu\text{m}$$

The resulting bearing clearance after tilting and axial displacement is 175 µm.

The influence of the difference in temperature between the inner ring and outer ring must also be taken into consideration.

The axial displacement facility for the bearing C3144-XL-K-C4 is shown as an example, *Figure 8*. The actual internal clearance as a function of axial displacement is shown in relation to the bearing width.



① Operating clearance in µm
② Axial displacement in mm
③ Tilting in °

Figure 8
Resulting operating clearance of the bearing C3144-XL-K-C4 as a function of tilting and axial displacement

Equivalent dynamic and static bearing load

Toroidal roller bearings can only support radial loads. As a result, $P = P_0 = F_r$.

Permissible dynamic bearing load

The permissible dynamic bearing load is always determined by $P \leqq 0{,}33 \cdot C_r$.

In the case of toroidal roller bearings up to a bore diameter $d = 200$ mm, the dynamic load is determined by $P \leqq 0{,}18 \cdot C_{0r}$.

In applications with very high dynamic loads, the rating life calculation must be carried out in greater detail. In these cases, please contact the technical advisory service of Schaeffler.

Minimum load

In order to ensure operation without slippage, the bearings must be subjected to a minimum radial load $F_{r\,min}$. This applies in particular to high speed bearings since, if the radial load is insufficient or not present, damaging sliding motion may occur between the rolling elements and raceways.

The requisite minimum radial load $F_{r\,min}$ is defined as:

$$F_{r\,min} = 0{,}0135 \cdot C_0$$

$F_{r\,min}$ kN
Minimum radial load

C_0 kN
Basic static load rating.

If oil lubrication is used, the requisite minimum load is reduced as a function of the bearing type and speed.

In order to calculate this reduction, the ancillary value k_r must first be calculated as follows:

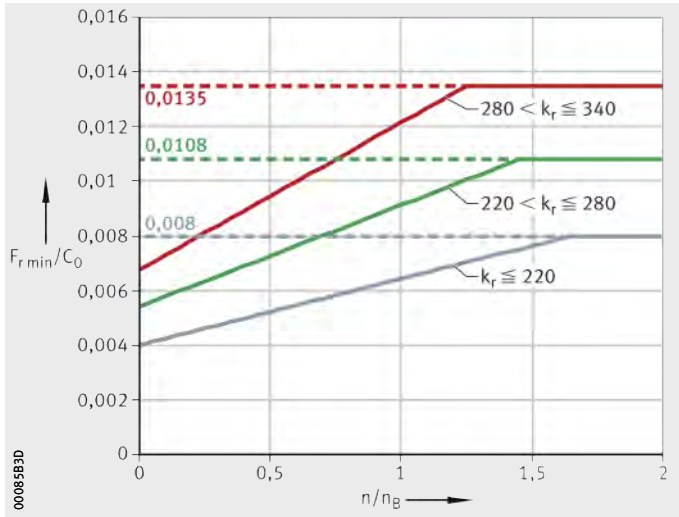
$$k_r = k_\delta \cdot d_M$$

k_r –
Ancillary value

k_δ –
Operating clearance factor, see dimension table

d_M mm
Mean bearing diameter (d+D)/2.

With the aid of this ancillary value and the ratio n/n_B, the requisite minimum load can be read off relative to the basic static load rating C_0, *Figure 9*.



$F_{r\,min}$ = minimum radial load
C_0 = basic static load rating
n = speed
n_B = reference speed
k_r = ancillary value

Figure 9
Minimum load with oil lubrication

Alternatively, the requisite minimum load can also be calculated, see table.

As a function of k_r, the factors for calculation of the minimum load should be selected as follows:

Factors for calculation of minimum load

Ancillary value k_r		Factor due to influence of load f_F	Speed parameter n_K
over	incl.		
–	220	0,0080	1,65
220	280	0,0108	1,45
280	340	0,0135	1,25

If $k_r > 340$, the method cannot be used. In such cases, the equation for the requisite minimum radial load $F_{r\,min}$ must be used.

The factor for determining the influence of speed relative to the reference speed n_B when using oil lubrication is defined as follows:

$$f_n = 0{,}5 \cdot \left(1 + \frac{n}{n_B \cdot n_K}\right), \text{ if } n < n_K \cdot n_B$$

$$f_n = 1, \text{ if } n \geqq n_K \cdot n_B$$

f_n –
Factor for determining the influence of speed.
In the case of full complement bearings: $f_n = 1$

n min^{-1}
Speed

n_B min^{-1}
Reference speed

n_K –
Speed parameter.

The requisite minimum load is as follows:

$$F_{r\,min} = f_F \cdot f_n \cdot C_0$$

$F_{r\,min}$ kN
Minimum radial load

f_F –
Factor due to influence of load

f_n –
Factor due to influence of speed

C_0 kN
Basic static load rating.

Higher minimum loads may be necessary under certain conditions when starting up at low temperature, when using greases with a high base oil viscosity and where bearings have been regreased.

Example 1

Calculation of the minimum load for the toroidal roller bearing C3144-XL-K-C4 at an operating speed of 260 min^{-1} with the aid of the diagram, *Figure 10*.

$$k_r = k_\delta \cdot d_M$$

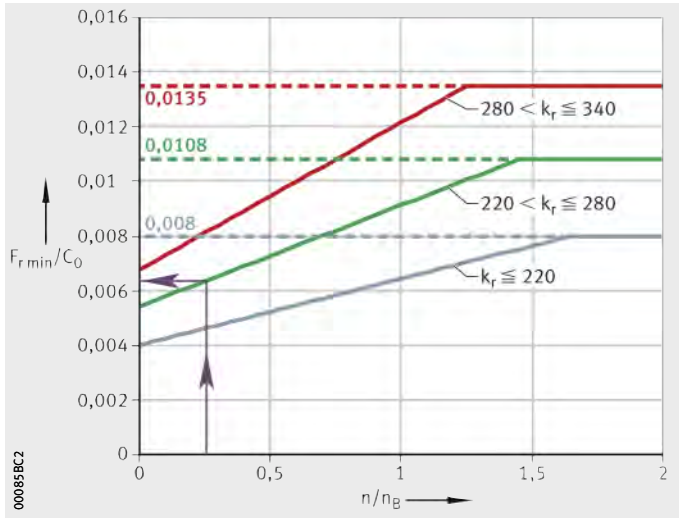
$$k_\delta = 0{,}791$$

$$d_M = \frac{220\ mm + 370\ mm}{2} = 295\ mm$$

$$k_r = 0{,}791 \cdot 295\ mm = 233{,}345\ mm \approx 233\ mm$$

$$\frac{n}{n_B} = \frac{260\ min^{-1}}{960\ min^{-1}} = 0{,}27$$

Since k_r = 233 mm, the green graph in the diagram is selected. n/n_B = 0,27 for $F_{r\,min}/C_0$ = 0,0064.



$F_{r\,min}$ = minimum radial load
C_0 = basic static load rating
n = speed
n_B = reference speed
k_r = ancillary value

Figure 10
Minimum load

For the toroidal roller bearing C3144-XL-K-C4 at C_0 = 2 900 kN, the result is:

$$F_{r\,min} = 0{,}0064 \cdot 2\,900\ kN = 18{,}6\ kN$$

Example 2

Calculation of the minimum load for the toroidal roller bearing C3144-XL-K-C4 at an operating speed of 260 min^{-1} and oil lubrication with the aid of table, page 17.

If $k_r \approx 233$ mm as in Example 1, this gives:

- $n_K = 1{,}45$
- $f_F = 0{,}0108$

If $n_B \cdot n_K = 960\ min^{-1} \cdot 1{,}45 = 1\,392\ min^{-1} > 260\ min^{-1}$, this gives:

$$f_n = 0{,}5 \cdot \left(1 + \frac{n}{n_B \cdot n_K}\right)$$

$$f_n = 0{,}5 \cdot \left(1 + \frac{260\ min^{-1}}{960\ min^{-1} \cdot 1{,}45}\right) = 0{,}593$$

and

$$F_{r\,min} = f_F \cdot f_n \cdot C_0$$

$$F_{r\,min} = 0{,}0108 \cdot 0{,}593 \cdot 2\,900\ kN \approx 18{,}6\ kN$$

Speeds

The reference speed given in the bearing tables can be exceeded up to the level of the limiting speed if permitted by the operating conditions. In order to take account of special operating conditions, the thermally safe operating speed is determined, see Catalogue HR 1, Rolling Bearings.

Tolerances

Bearings with a cylindrical bore and tapered bore have normal tolerances in accordance with DIN 620-2:1988 and respectively ISO 492:2014.

The running accuracy for the inner ring and outer ring corresponds to the tolerance class 5.

Toroidal roller bearings

Design of bearing arrangements

When designing the bearing arrangement, attention must be paid to:

- the axial location of bearings
- the fits
- the accuracy of mating parts
- free space.

Axial location of bearings

In the case of toroidal roller bearings, the inner ring and outer ring must be axially located on both sides not only on the shaft but also in the housing bore. The bearing rings should therefore be mounted such that one side is in contact against a shoulder on the shaft or in the housing.

The other side of the inner ring can be axially located by means of:

- a shaft nut
- a retaining ring
- a screw mounted end washer on the end of the shaft.

The outer rings can normally be axially located and retained in the housing bore by means of the cover, *Figure 11*.

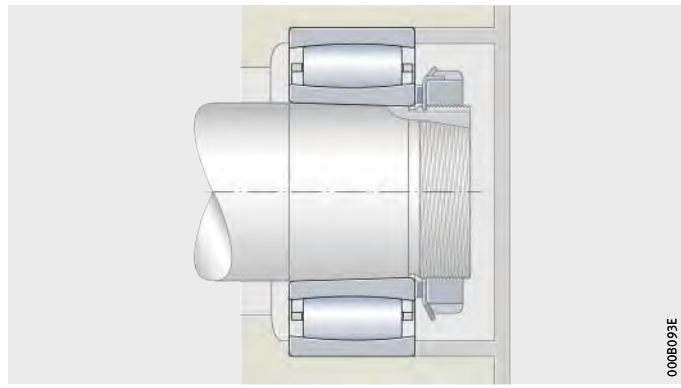


Figure 11
Retention by means of retaining nut

Fits

For toroidal roller bearings, the shaft and housing fits used should be on the same basis as in Catalogue HR 1, Rolling Bearings.

Accuracy of mating parts

The accuracy of the cylindrical bearing seats on shafts and in housings should correspond to the accuracy of the bearings used. For toroidal roller bearings, the tolerances used should be on the same basis as in Catalogue HR 1, Rolling Bearings, or specific recommendations for the application should be observed.

Free space

Toroidal roller bearings can compensate thermally-induced changes in the length of the shaft relative to the housing within the bearing. In order to ensure the function of the bearing, free space must be provided on both end faces of the bearings, *Figure 12*.

For bearings with a cage, the minimum values we recommend for the depth of the free space are as follows:

$$C_{a\,req} = C_a + 0{,}5 \cdot \left(\delta_{ax} + s_\varphi\right)$$

$C_{a\,req}$ mm
Requisite value for the depth of the free space

C_a mm
Minimum value for depth of free space in the case of bearing rings without offset, see dimension table

δ_{ax} mm
Axial displacement from central position

s_φ mm
Reduction in axial displacement facility as a result of tilting.

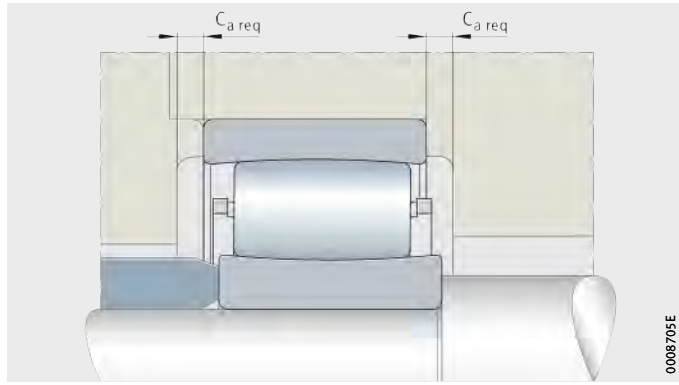


Figure 12
Free space in housing

In standard mounting, the bearing rings are fitted concentrically in relation to each other. If significant changes in length occur in one direction in the application due to heat, the inner ring can be fitted offset relative to the outer ring in the opposing direction by up to the maximum permissible axial displacement. As a result, there is a significant increase in the possible axial displacement.

Toroidal roller bearings can be axially located by means of shaft nuts KML or KM and tab washers MBL-T or MB-T, *Figure 11*, page 20. For bearings with a bore diameter larger than 200 mm, we recommend nuts of series HM30 with retaining brackets MS30.

Toroidal roller bearings

In the axial location of toroidal roller bearings with retaining nuts, it must be ensured that the cage of the bearing does not graze the retaining nut or retaining bracket if the shaft undergoes axial displacements. The outside diameter of the retaining nut should always be smaller than the mounting dimension $d_{a\ max}$ given in the dimension table.

If this is not possible, an intermediate ring can be arranged between the bearing and means of retention and the thread on the shaft can be made correspondingly longer.

Mounting guidelines

The mounting and dismounting of toroidal roller bearings with a cylindrical bore and of smaller bearings with a tapered bore should be carried out in accordance with the guidelines indicated in our Catalogue HR 1, Rolling Bearings, in the section Mounting and dismounting. For the mounting and dismounting of larger bearings on a tapered journal or sleeves, we recommend the use of the hydraulic method, see Publication MH 1, Mounting of Rolling Bearings.

Toroidal roller bearings on adapter sleeve or withdrawal sleeve

Toroidal roller bearings with a tapered bore can be mounted on smooth or stepped shafts by means of an adapter sleeve or withdrawal sleeve, *Figure 13*. In the case of substantial axial displacements, it must be ensured that the axial displacement always occurs in the direction of the sleeve nut. The Schaeffler adapter sleeves have been adapted specially for the TORB bearings in order to fulfil the particular requirements of these designs. For TORB bearings, please use adapter sleeves with the suffix T, for example H24026-T. For general information on the mounting of rolling bearings on adapter sleeves and withdrawal sleeves, see Catalogue HR 1, Rolling Bearings.

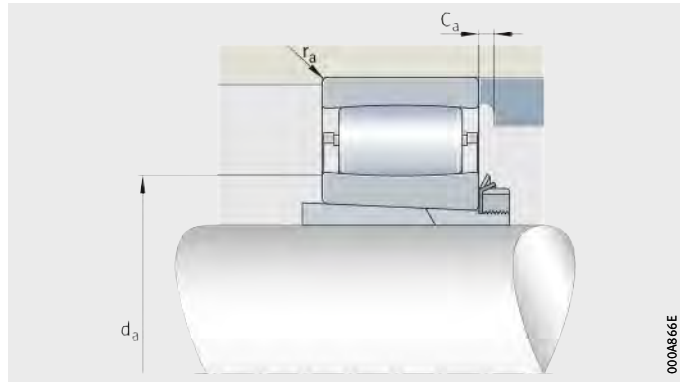


Figure 13
Toroidal roller bearing on adapter sleeve

Reduced radial internal clearance in mounting

When bearings with a tapered bore are mounted, there is a reduction in the radial internal clearance.

The values indicated values ensure a secure seat on the shaft, see table.

Reduction in radial internal clearance of FAG toroidal roller bearings with tapered bore

Nominal bearing bore diameter d		Radial internal clearance before mounting Internal clearance group					
		CN (Group N)		C3 (Group 3)		C4 (Group 4)	
over	incl.	min.	max.	min.	max.	min.	max.
mm	mm	mm	mm	mm	mm	mm	mm
24	**30**	0,035	0,055	0,050	0,065	0,065	0,085
30	**40**	0,045	0,065	0,060	0,080	0,080	0,100
40	**50**	0,050	0,075	0,070	0,095	0,090	0,120
50	**65**	0,060	0,090	0,085	0,115	0,110	0,150
65	**80**	0,075	0,110	0,105	0,140	0,135	0,180
80	**100**	0,095	0,135	0,130	0,175	0,170	0,220
100	**120**	0,115	0,155	0,155	0,205	0,200	0,255
120	**140**	0,135	0,180	0,180	0,235	0,230	0,295
140	**160**	0,155	0,215	0,210	0,270	0,265	0,340
160	**180**	0,170	0,240	0,235	0,305	0,300	0,385
180	**200**	0,190	0,260	0,260	0,330	0,325	0,420
200	**225**	0,210	0,290	0,285	0,365	0,360	0,460
225	**250**	0,235	0,315	0,315	0,405	0,400	0,515
250	**280**	0,255	0,345	0,340	0,445	0,440	0,560
280	**315**	0,280	0,380	0,375	0,485	0,480	0,620
315	**355**	0,315	0,420	0,415	0,545	0,540	0,680
355	**400**	0,350	0,475	0,470	0,600	0,595	0,755
400	**450**	0,380	0,525	0,525	0,655	0,650	0,835
450	**500**	0,435	0,575	0,575	0,735	0,730	0,915
500	**560**	0,470	0,640	0,630	0,810	0,800	1,010
560	**630**	0,530	0,710	0,700	0,890	0,880	1,110
630	**710**	0,590	0,780	0,770	0,990	0,980	1,230
710	**800**	0,670	0,860	0,860	1,100	1,100	1,380
800	**900**	0,730	0,960	0,950	1,220	1,210	1,530
900	**1 000**	0,810	1,040	1,040	1,340	1,340	1,670
1 000	**1 120**	0,890	1,170	1,160	1,500	1,490	1,880
1 120	**1 250**	0,970	1,280	1,270	1,640	1,630	2,060
1 250	**1 400**	1,080	1,410	1,410	1,790	1,780	2,250
1 400	**1 600**	1,200	1,550	1,550	1,990	1,990	2,500
1 600	**1 800**	1,320	1,690	1,690	2,180	2,180	2,730

[1] Valid only for solid steel shafts and hollow shafts with a bore no larger than half the shaft diameter.
The following applies: Bearings with a radial internal clearance before mounting in the upper half of the tolerance range are mounted using the larger value for the reduction in radial internal clearance or the axial displacement distance, while bearings in the lower half of the tolerance range are mounted using the smaller value for the reduction in radial internal clearance or the axial displacement distance.

Reduction in radial internal clearance[1]		Drive-up distance on taper 1:12[1] the shaft		Drive-up distance on taper 1:30[1] the shaft		Control value for radial internal clearance after mounting		
						CN (Group N)	C3 (Group 3)	C4 (Group 4)
min.	max.	min.	max.	min.	max.	min.	min.	min.
mm	mm	mm	mm	mm	mm	mm	mm	mm
0,010	0,017	0,24	0,29	0,61	0,72	0,025	0,035	0,048
0,014	0,021	0,30	0,34	0,76	0,84	0,031	0,041	0,059
0,018	0,028	0,37	0,42	0,91	1,04	0,033	0,046	0,062
0,024	0,035	0,46	0,50	1,14	1,24	0,036	0,054	0,075
0,030	0,046	0,55	0,61	1,37	1,53	0,045	0,065	0,090
0,040	0,056	0,67	0,73	1,68	1,83	0,056	0,080	0,114
0,049	0,069	0,79	0,89	1,98	2,23	0,066	0,093	0,131
0,060	0,083	0,91	1,05	2,29	2,62	0,075	0,105	0,147
0,072	0,095	1,04	1,21	2,59	3,02	0,083	0,123	0,170
0,081	0,107	1,16	1,36	2,90	3,41	0,089	0,137	0,193
0,090	0,121	1,28	1,52	3,20	3,81	0,100	0,150	0,204
0,101	0,134	1,43	1,68	3,58	4,20	0,109	0,162	0,226
0,113	0,151	1,59	1,88	3,96	4,69	0,123	0,177	0,249
0,126	0,168	1,77	2,08	4,42	5,19	0,129	0,186	0,273
0,142	0,188	1,98	2,31	4,95	5,78	0,138	0,203	0,292
0,160	0,211	2,23	2,59	5,56	6,47	0,155	0,221	0,329
0,180	0,238	2,50	2,90	6,25	7,26	0,170	0,251	0,357
0,203	0,268	2,81	3,26	7,01	8,15	0,178	0,279	0,382
0,225	0,300	3,11	3,66	7,78	9,14	0,210	0,300	0,430
0,250	0,335	3,48	4,05	8,69	10,13	0,220	0,325	0,465
0,285	0,375	3,90	4,52	9,76	11,31	0,245	0,355	0,505
0,320	0,420	4,39	5,08	10,98	12,69	0,270	0,380	0,560
0,360	0,475	4,94	5,71	12,35	14,27	0,310	0,425	0,625
0,405	0,535	5,55	6,42	13,88	16,05	0,325	0,460	0,675
0,450	0,605	6,16	7,21	15,40	18,03	0,360	0,490	0,735
0,505	0,670	6,89	8,00	17,23	20,00	0,385	0,545	0,820
0,565	0,750	7,69	8,95	19,21	22,37	0,410	0,580	0,880
0,630	0,840	8,60	9,98	21,50	24,94	0,450	0,640	0,940
0,720	0,940	9,82	11,16	24,55	27,90	0,480	0,685	1,050
0,810	1,070	11,04	12,74	27,60	31,85	0,510	0,705	1,110

Toroidal roller bearings

Accuracy

The main dimensions of the toroidal roller bearings listed in the dimension tables match the data in DIN 616:1994 and ISO 15:1981 respectively.

Radial internal clearance

The values for the radial internal clearance of bearings with a cylindrical bore, see table, and those for bearings with a tapered bore, see table, page 28, are valid for unmounted bearings with a measurement load of zero.

Axial displacements of the bearing rings relative to each other will reduce the internal clearance of toroidal roller bearings. This reduction can be determined, see page 13.

Radial internal clearance of bearings with cylindrical bore

Hole d mm		Radial internal clearance C2 (Group 2) µm		CN (Group N) µm	
over	incl.	min.	max.	min.	max.
18	24	15	30	25	40
24	30	15	35	30	50
30	40	20	40	35	55
40	50	25	45	45	65
50	65	30	55	50	80
65	80	40	70	65	100
80	100	50	85	80	120
100	120	60	100	100	145
120	140	75	120	115	170
140	160	85	140	135	195
160	180	95	155	150	220
180	200	105	175	170	240
200	225	115	190	185	265
225	250	125	205	200	285
250	280	135	225	220	310
280	315	150	240	235	330
315	355	160	260	255	360
355	400	175	280	280	395
400	450	190	310	305	435
450	500	205	335	335	475
500	560	220	360	360	520
560	630	240	400	390	570
630	710	260	440	430	620
710	800	300	500	490	680
800	900	320	540	530	760
900	1 000	370	600	590	830
1 000	1 120	410	660	660	930
1 120	1 250	450	720	720	1 020
1 250	1 400	490	800	800	1 130
1 400	1 600	570	890	890	1 250
1 600	1 800	650	1 010	1 010	1 390

Radial internal clearance of bearings with cylindrical bore (continued)

Bore d mm		Radial internal clearance					
		C3 (Group 3) µm		C4 (Group 4) µm		C5 (Group 5) µm	
over	incl.	min.	max.	min.	max.	min.	max.
18	24	35	55	50	65	65	85
24	30	45	60	60	80	75	95
30	40	55	75	70	95	90	120
40	50	65	85	85	110	105	140
50	65	75	105	100	140	135	175
65	80	95	125	120	165	160	210
80	100	120	160	155	210	205	260
100	120	140	190	185	245	240	310
120	140	165	215	215	280	280	350
140	160	195	250	250	325	320	400
160	180	215	280	280	365	360	450
180	200	235	310	305	395	390	495
200	225	260	340	335	435	430	545
225	250	280	370	365	480	475	605
250	280	305	410	405	520	515	655
280	315	330	435	430	570	570	715
315	355	360	485	480	620	620	790
355	400	395	530	525	675	675	850
400	450	435	580	575	745	745	930
450	500	475	635	630	815	810	1 015
500	560	510	690	680	890	890	1 110
560	630	560	760	750	980	970	1 220
630	710	610	840	830	1 080	1 070	1 340
710	800	680	920	920	1 200	1 200	1 480
800	900	750	1 020	1 010	1 330	1 320	1 660
900	1 000	830	1 120	1 120	1 460	1 460	1 830
1 000	1 120	930	1 260	1 260	1 640	1 640	2 040
1 120	1 250	1 020	1 380	1 380	1 800	1 800	2 240
1 250	1 400	1 130	1 510	1 540	1 970	1 970	2 460
1 400	1 600	1 250	1 680	1 680	2 200	2 200	2 740
1 600	1 800	1 390	1 870	1 870	2 430	2 430	3 000

Radial internal clearance of bearings with tapered bore

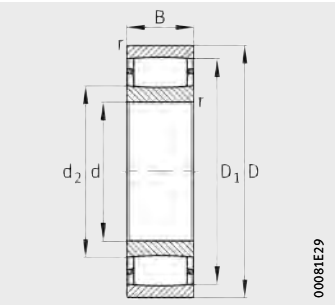
Bore d mm		Radial internal clearance			
		C2 (Group 2) µm		CN (Group N) µm	
over	incl.	min.	max.	min.	max.
18	24	15	35	30	45
24	30	20	40	35	55
30	40	25	50	45	65
40	50	30	55	50	75
50	65	40	65	60	90
65	80	50	80	75	110
80	100	60	100	95	135
100	120	75	115	115	155
120	140	90	135	135	180
140	160	100	155	155	215
160	180	115	175	170	240
180	200	130	195	190	260
200	225	140	215	210	290
225	250	160	235	235	315
250	280	170	260	255	345
280	315	195	285	280	380
315	355	220	320	315	420
355	400	250	350	350	475
400	450	280	385	380	525
450	500	305	435	435	575
500	560	330	480	470	640
560	630	380	530	530	710
630	710	420	590	590	780
710	800	480	680	670	860
800	900	520	740	730	960
900	1 000	580	820	810	1 040
1 000	1 120	640	900	890	1 170
1 120	1 250	700	980	970	1 280
1 250	1 400	770	1 080	1 080	1 410
1 400	1 600	870	1 200	1 200	1 550
1 600	1 800	950	1 320	1 320	1 690

Radial internal clearance of bearings with tapered bore (continued)

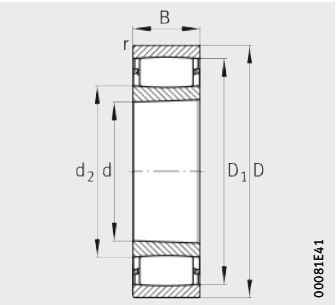
Bore d mm		Radial internal clearance					
		C3 (Group 3) µm		C4 (Group 4) µm		C5 (Group 5) µm	
over	incl.	min.	max.	min.	max.	min.	max.
18	24	40	55	55	70	65	85
24	30	50	65	65	85	80	100
30	40	60	80	80	100	100	125
40	50	70	95	90	120	115	145
50	65	85	115	110	150	145	185
65	80	105	140	135	180	175	220
80	100	130	175	170	220	215	275
100	120	155	205	200	255	255	325
120	140	180	235	230	295	290	365
140	160	210	270	265	340	335	415
160	180	235	305	300	385	380	470
180	200	260	330	325	420	415	520
200	225	285	365	360	460	460	575
225	250	315	405	400	515	510	635
250	280	340	445	440	560	555	695
280	315	375	485	480	620	615	765
315	355	415	545	540	680	675	850
355	400	470	600	595	755	755	920
400	450	525	655	650	835	835	1 005
450	500	575	735	730	915	910	1 115
500	560	630	810	800	1 010	1 000	1 230
560	630	700	890	880	1 110	1 110	1 350
630	710	770	990	980	1 230	1 230	1 490
710	800	860	1 100	1 100	1 380	1 380	1 660
800	900	950	1 220	1 210	1 530	1 520	1 860
900	1 000	1 040	1 340	1 340	1 670	1 670	2 050
1 000	1 120	1 160	1 500	1 490	1 880	1 870	2 280
1 120	1 250	1 270	1 640	1 630	2 060	2 050	2 500
1 250	1 400	1 410	1 790	1 780	2 250	2 250	2 740
1 400	1 600	1 550	1 990	1 990	2 500	2 500	3 050
1 600	1 800	1 690	2 180	2 180	2 730	2 730	3 310

Toroidal roller bearings

Cylindrical or tapered bore



Cylindrical bore



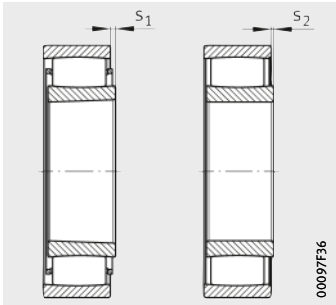
Tapered bore

X-life

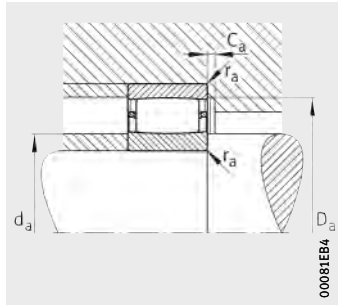
Dimension table · Dimensions in mm

Designation	Mass	Dimensions						Mounting dimensions			
	m	d	D	B	r	D_1 ≈	d_2 ≈	D_a		d_a	
	≈ kg				min.			max.	min.	max.	min.
C2212-XL-K-V	1,12	**60**	110	28	1,5	98,1	77,1	101	–	85	69
C2212-XL-V	1,15	**60**	110	28	1,5	98,1	77,1	101	–	85	69
C4013-XL-K30-V	0,95	**65**	100	35	1,1	88,6	74,7	94	–	82	71
C4013-XL-V	0,98	**65**	100	35	1,1	88,6	74,7	94	–	82	71
C2213-XL-K-V	1,48	**65**	120	31	1,5	106,1	78,9	111	–	97	74
C2213-XL-V	1,52	**65**	120	31	1,5	106,1	78,9	111	–	97	74
C2214-XL-K-V	1,56	**70**	125	31	1,5	111,1	83,6	116	–	97	79
C2214-XL-V	1,6	**70**	125	31	1,5	111,1	83,6	116	–	97	79
C2314-XL	4,33	**70**	150	51	2,1	130,9	92,5	138	121	105	82
C2314-XL-K	4,22	**70**	150	51	2,1	130,9	92,5	138	121	105	82
C4015-XL-K30-V	1	**75**	115	40	1,1	100,2	89,5	109	–	97	81
C4015-XL-V	1,47	**75**	115	40	1,1	100,2	89,5	109	–	97	81
C2215-XL	1,69	**75**	130	31	1,5	115,4	88	121	110	96	84
C2215-XL-K	1,64	**75**	130	31	1,5	115,4	88	121	110	96	84
C2215-XL-K-V	1,64	**75**	130	31	1,5	115,4	88	121	–	102	84
C2215-XL-V	1,69	**75**	130	31	1,5	115,4	88	121	–	102	84
C2315-XL	5,3	**75**	160	55	2,1	136,5	99	148	127	111	87
C2315-XL-K	5,16	**75**	160	55	2,1	136,5	99	148	127	111	87
C2216-XL	2,1	**80**	140	33	2	125,5	98,2	129	120	106	91
C2216-XL-K	2,05	**80**	140	33	2	125,5	98,2	129	120	106	91
C2216-XL-K-V	2,05	**80**	140	33	2	125,5	98,2	129	–	116	91
C2216-XL-V	2,1	**80**	140	33	2	125,5	98,2	129	–	116	91
C2316-XL	6,3	**80**	170	58	2,1	145,5	103,5	158	135	117	92
C2316-XL-K	6,1	**80**	170	58	2,1	145,5	103,5	158	135	117	92
C2217-XL-V	2,65	**85**	150	36	2	132,2	104,8	139	–	117	96
C2217-XL-K-V	2,58	**85**	150	36	2	132,2	104,8	139	–	117	96
C2217-XL	2,65	**85**	150	36	2	132,2	104,8	139	126	113	96
C2217-XL-K	2,58	**85**	150	36	2	132,2	104,8	139	126	113	96
C2317-XL	7,29	**85**	180	60	3	153,9	111,1	166	143	125	99
C2317-XL-K	7,1	**85**	180	60	3	153,9	111,1	166	143	125	99

Before ordering, availability for delivery must be checked.



Displacement distance

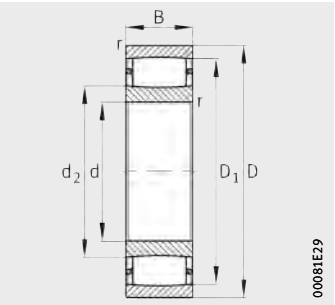


Mounting dimensions

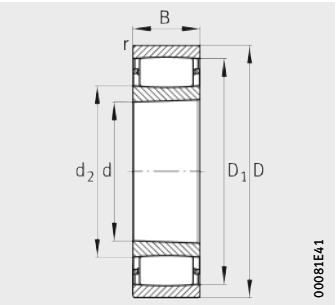
				Basic load ratings		Calculation factors		Fatigue limit load	Limiting speed	Reference speed
C_a	r_a	s_1	s_2	dyn. C	stat. C_0	k_φ	k_δ	C_u	n_G	n_B
min.	max.			N	N			N	min^{-1}	min^{-1}
–	1,5	8,5	5,3	171 000	195 000	3,116	3,713	32 500	2 650	–
–	1,5	8,5	5,3	171 000	195 000	3,116	3,713	32 500	2 650	–
–	1	6	2,8	197 000	285 000	3,543	3,082	33 500	3 050	–
–	1	6	2,8	197 000	285 000	3,543	3,082	33 500	3 050	–
–	1,5	9,6	5,3	208 000	216 000	3,298	3,505	36 000	2 340	–
–	1,5	9,6	5,3	208 000	216 000	3,298	3,505	36 000	2 340	–
–	1,5	9,6	5,3	215 000	229 000	3,523	3,265	38 000	2 180	–
–	1,5	9,6	5,3	215 000	229 000	3,523	3,265	38 000	2 180	–
1,6	2	9,1	–	405 000	440 000	5,477	1,941	52 000	6 000	3 200
1,6	2	9,1	–	405 000	440 000	5,477	1,941	52 000	6 000	3 200
–	1	9,4	5,1	209 000	355 000	3,893	2,845	39 500	2 470	–
–	1	9,4	5,1	209 000	355 000	3,893	2,845	39 500	2 470	–
1,11	1,5	9,6	–	197 000	207 000	3,56	3,268	33 000	7 000	3 250
1,11	1,5	9,6	–	197 000	207 000	3,56	3,268	33 000	7 000	3 250
–	1,5	9,6	5,3	221 000	241 000	3,56	3,268	38 500	2 050	–
–	1,5	9,6	5,3	221 000	241 000	3,56	3,268	38 500	2 050	–
1,5	2	13,1	–	430 000	470 000	5,53	1,941	56 000	5 600	3 200
1,5	2	13,1	–	430 000	470 000	5,53	1,941	56 000	5 600	3 200
1,1	2	9,1	–	224 000	250 000	3,889	2,997	41 000	6 300	2 900
1,1	2	9,1	–	224 000	250 000	3,889	2,997	41 000	6 300	2 900
–	2	9,1	4,8	260 000	305 000	3,889	2,997	49 500	1 790	–
–	2	9,1	4,8	260 000	305 000	3,889	2,997	49 500	1 790	–
1,7	2	10,1	–	510 000	550 000	6,094	1,745	62 000	5 100	3 050
1,7	2	10,1	–	510 000	550 000	6,094	1,745	62 000	5 100	3 050
–	2	7,1	1,7	315 000	395 000	4,194	2,763	59 000	1 640	–
–	2	7,1	1,7	315 000	395 000	4,194	2,763	59 000	1 640	–
1,1	2	7,1	–	275 000	330 000	4,194	2,763	49 000	5 900	2 750
1,1	2	7,1	–	275 000	330 000	4,194	2,763	49 000	5 900	2 750
1,72	2,5	12,1	–	550 000	610 000	6,144	1,752	68 000	4 800	2 850
1,72	2,5	12,1	–	550 000	610 000	6,144	1,752	68 000	4 800	2 850

Toroidal roller bearings

Cylindrical or tapered bore



Cylindrical bore



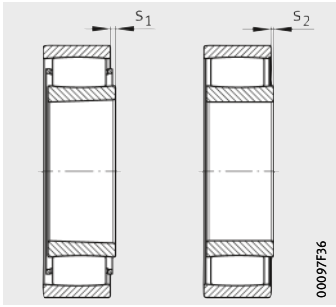
Tapered bore

X-life

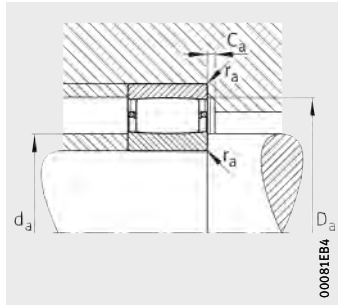
Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions						Mounting dimensions			
	m	d	D	B	r	D_1 ≈	d_2 ≈	D_a		d_a	
	≈ kg				min.			max.	min.	max.	min.
C2218-XL-K	3,29	**90**	160	40	2	143,9	112,1	149	137	122	101
C2218-XL	3,38	**90**	160	40	2	143,9	112,1	149	137	122	101
C2318-XL-K	8,4	**90**	190	64	3	167,4	119,6	176	154	136	104
C2318-XL	8,65	**90**	190	64	3	167,4	119,6	176	154	136	104
C2219-XL-K	4,01	**95**	170	43	2,1	149,7	112,3	158	140	125	107
C2219-XL	4,12	**95**	170	43	2,1	149,7	112,3	158	140	125	107
C2319-XL-K	9,75	**95**	200	67	3	167,6	120,4	186	155	137	109
C2319-XL	10	**95**	200	67	3	167,6	120,4	186	155	137	109
C4020-XL-K30-V	2,94	**100**	150	50	1,5	133,6	113,6	141	–	125	109
C4020-XL-V	3,02	**100**	150	50	1,5	133,6	113,6	141	–	125	109
C3120-XL-K-V	4,21	**100**	165	52	2	150,7	119,7	154	–	132	111
C3120-XL-V	4,32	**100**	165	52	2	150,7	119,7	154	–	132	111
C4120-XL-K30-V	5,26	**100**	165	65	2	147,4	120,6	154	–	132	111
C4120-XL-V	5,4	**100**	165	65	2	147,4	120,6	154	–	132	111
C2220-XL	4,97	**100**	180	46	2,1	156,9	118,1	168	147	131	112
C2220-XL-K	4,84	**100**	180	46	2,1	156,9	118,1	168	147	131	112
C2320-XL-K	12,4	**100**	215	73	3	184	129	201	169	148	114
C2320-XL	12,8	**100**	215	73	3	184	129	201	169	148	114
C3022-XL	3,65	**110**	170	45	2	156,2	127,8	161	151	136	119
C3022-XL-K	3,55	**110**	170	45	2	156,2	127,8	161	151	136	119
C4022-XL-K30-V	4,74	**110**	170	60	2	151,2	127,2	160	–	140	120
C4022-XL-V	4,86	**110**	170	60	2	151,2	127,2	160	–	140	120
C4122-XL-K30-V	6,58	**110**	180	69	2	163	132,7	170	–	145	120
C4122-XL-V	6,76	**110**	180	69	2	163	132,7	170	–	145	120
C2222-XL	7,14	**110**	200	53	2,1	178,5	135,9	188	168	150	122
C2222-XL-K	6,95	**110**	200	53	2,1	178,5	135,9	188	168	150	122

Before ordering, availability for delivery must be checked.



Displacement distance

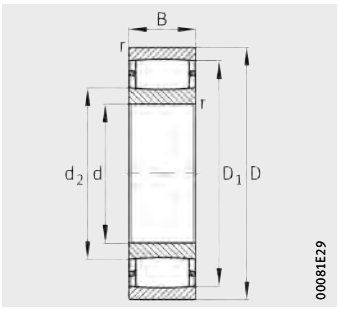


Mounting dimensions

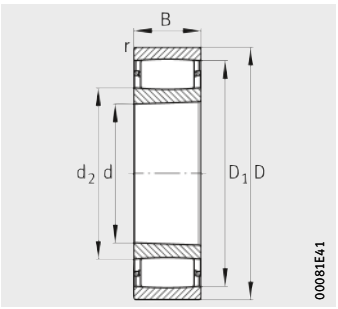
				Basic load ratings		Calculation factors		Fatigue limit load	Limiting speed	Reference speed
C_a	r_a	s_1	s_2	dyn. C	stat. C_0	k_φ	k_δ	C_u	n_G	n_B
min.	max.			N	N			N	min^{-1}	min^{-1}
1,3	2	9,5	–	330 000	380 000	4,103	2,924	55 000	5 300	2 650
1,3	2	9,5	–	330 000	380 000	4,103	2,924	55 000	5 300	2 650
1,9	2,5	9,6	–	650 000	740 000	6,754	1,589	77 000	4 350	2 500
1,9	2,5	9,6	–	650 000	740 000	6,754	1,589	77 000	4 350	2 500
1,5	2	10,5	–	370 000	405 000	4,75	2,42	61 000	5 000	2 750
1,5	2	10,5	–	370 000	405 000	4,75	2,42	61 000	5 000	2 750
1,9	2,5	12,6	–	660 000	750 000	6,758	1,589	78 000	4 350	2 600
1,9	2,5	12,6	–	660 000	750 000	6,758	1,589	78 000	4 350	2 600
–	1,5	14	9,7	355 000	530 000	4,766	2,365	66 000	1 580	–
–	1,5	14	9,7	355 000	530 000	4,766	2,365	66 000	1 580	–
–	2	10	4,7	490 000	660 000	6,699	1,582	86 000	1 330	–
–	2	10	4,7	490 000	660 000	6,699	1,582	86 000	1 330	–
–	2	17,7	5,2	530 000	730 000	5,69	1,929	83 000	1 350	–
–	2	17,7	5,2	530 000	730 000	5,69	1,929	83 000	1 350	–
1,6	2	10,1	–	420 000	470 000	4,849	2,393	68 000	4 700	2 700
1,6	2	10,1	–	420 000	470 000	4,849	2,393	68 000	4 700	2 700
2,2	2,5	11,2	–	820 000	920 000	8,026	1,312	97 000	3 850	2 290
2,2	2,5	11,2	–	820 000	920 000	8,026	1,312	97 000	3 850	2 290
1,8	2	9,5	–	360 000	480 000	5,707	1,954	63 000	4 800	2 480
1,8	2	9,5	–	360 000	480 000	5,707	1,954	63 000	4 800	2 480
–	2	12	6,6	510 000	800 000	6,296	1,717	89 000	1 320	–
–	2	12	6,6	510 000	800 000	6,296	1,717	89 000	1 320	–
–	2	11,4	4,6	680 000	1 000 000	6,99	1,529	104 000	1 160	–
–	2	11,4	4,6	680 000	1 000 000	6,99	1,529	104 000	1 160	–
2	2	11,1	–	550 000	650 000	5,866	1,941	89 000	4 050	2 330
2	2	11,1	–	550 000	650 000	5,866	1,941	89 000	4 050	2 330

Toroidal roller bearings

Cylindrical or tapered bore



Cylindrical bore



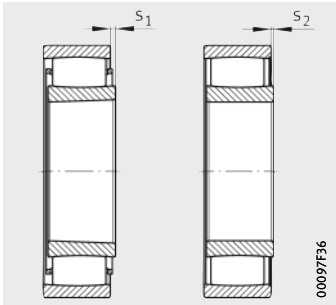
Tapered bore

X-life

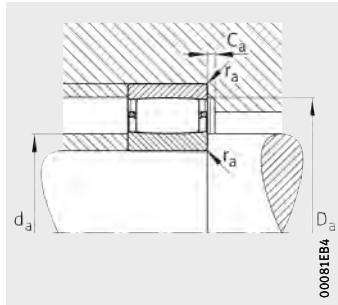
Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions						Mounting dimensions			
	m	d	D	B	r	D_1 ≈	d_2 ≈	D_a		d_a	
	≈ kg				min.			max.	min.	max.	min.
C3024-XL-V	4	**120**	180	46	2	166	138	171	–	150	129
C3024-XL-K-V	3,88	**120**	180	46	2	166	138	171	–	150	129
C3024-XL	4	**120**	180	46	2	165,5	137,9	171	161	150	129
C3024-XL-K	3,89	**120**	180	46	2	165,5	137,9	171	161	150	129
C4024-XL-K30-V	5,08	**120**	180	60	2	165,6	141,6	171	–	150	129
C4024-XL-V	5,2	**120**	180	60	2	165,6	141,6	171	–	150	129
C4124-XL-K30-V	9,63	**120**	200	80	2	174	142	189	–	160	131
C4124-XL-V	9,88	**120**	200	80	2	174	142	189	–	160	131
C2224-XL	8,91	**120**	215	58	2,1	190,2	144,8	203	178	160	132
C2224-XL-K	8,68	**120**	215	58	2,1	190,2	144,8	203	178	160	132
C3224-XL-K	11,3	**120**	215	76	2,1	190	149	203	180	162	132
C3224-XL	11,7	**120**	215	76	2,1	190	149	203	180	162	132
C3026-XL-K	5,63	**130**	200	52	2	179,9	154,1	191	176	161	139
C3026-XL	5,8	**130**	200	52	2	179,9	154,1	191	176	161	139
C4026-XL-K30-V	7,49	**130**	200	69	2	179,8	150,2	191	–	165	139
C4026-XL-V	7,69	**130**	200	69	2	179,8	150,2	191	–	165	139
C4126-XL-K30-V	10,2	**130**	210	80	2	188,4	154,6	199	–	170	141
C4126-XL-V	10,5	**130**	210	80	2	188,4	154,6	199	–	170	141
C2226-XL	11,1	**130**	230	64	3	199,3	151,7	216	188	167	144
C2226-XL-K	10,8	**130**	230	64	3	199,3	151,7	216	188	167	144
C2326-XL	27,6	**130**	280	93	4	236	179	263	–	205	147
C2326-XL-K	26,9	**130**	280	93	4	236	179	263	–	205	147
C3028-XL-K	6,1	**140**	210	53	2	193,9	163,1	201	188	172	149
C3028-XL	6,27	**140**	210	53	2	193,9	163,1	201	188	172	149
C4028-XL-V	8,16	**140**	210	69	2	191,1	161,5	201	–	175	149
C4028-XL-K30-V	7,95	**140**	210	69	2	191,1	161,5	201	–	175	149
C4128-XL-K30-V	12,4	**140**	225	85	2,1	203,2	166,8	214	–	182	151
C4128-XL-V	12,7	**140**	225	85	2,1	203,2	166,8	214	–	182	151
C2228-XL	14,1	**140**	250	68	3	221,4	174,6	236	210	190	154
C2228-XL-K	13,7	**140**	250	68	3	221,4	174,6	236	210	190	154

Before ordering, availability for delivery must be checked.



Displacement distance

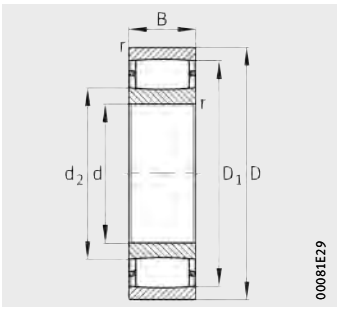


Mounting dimensions

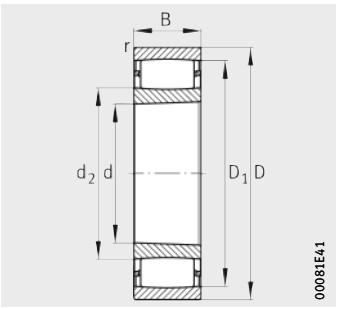
				Basic load ratings		Calculation factors		Fatigue limit load	Limiting speed	Reference speed
C_a	r_a	s_1	s_2	dyn. C	stat. C_0	k_φ	k_δ	C_u	n_G	n_B
min.	max.			N	N			N	min^{-1}	min^{-1}
–	2	10,6	3,8	435 000	630 000	6,176	1,799	81 000	1 140	–
–	2	10,6	3,8	435 000	630 000	6,176	1,799	81 000	1 140	–
1,7	2	10,6	–	390 000	550 000	6,176	1,799	70 000	4 450	2 290
1,7	2	10,6	–	390 000	550 000	6,176	1,799	70 000	4 450	2 290
–	2	12	5,2	550 000	890 000	6,421	1,717	99 000	1 120	–
–	2	12	5,2	550 000	890 000	6,421	1,717	99 000	1 120	–
–	2	18	11,2	780 000	1 140 000	7,458	1,435	124 000	1 030	–
–	2	18	11,2	780 000	1 140 000	7,458	1,435	124 000	1 030	–
1,9	2	13	–	630 000	740 000	6,372	1,778	101 000	3 700	2 200
1,9	2	13	–	630 000	740 000	6,372	1,778	101 000	3 700	2 200
1,5	2	17,1	–	760 000	1 000 000	7,65	1,423	92 000	3 700	1 960
1,5	2	17,1	–	760 000	1 000 000	7,65	1,423	92 000	3 700	1 960
0,8	2	16,5	–	405 000	600 000	6,777	1,641	74 000	4 000	2 210
0,8	2	16,5	–	405 000	600 000	6,777	1,641	74 000	4 000	2 210
–	2	11,4	4,6	730 000	1 130 000	7,137	1,531	119 000	990	–
–	2	11,4	4,6	730 000	1 130 000	7,137	1,531	119 000	990	–
–	2	18	9,7	840 000	1 240 000	7,568	1,437	129 000	910	–
–	2	18	9,7	840 000	1 240 000	7,568	1,437	129 000	910	–
2	2,5	9,6	–	760 000	970 000	6,983	1,602	119 000	3 550	2 040
2	2,5	9,6	–	760 000	970 000	6,983	1,602	119 000	3 550	2 040
2,12	3	31,2	–	1 040 000	1 270 000	9,001	1,216	135 000	2 800	1 710
2,12	3	31,2	–	1 040 000	1 270 000	9,001	1,216	135 000	2 800	1 710
1	2	11	–	495 000	730 000	7,08	1,581	88 000	3 650	1 940
1	2	11	–	495 000	730 000	7,08	1,581	88 000	3 650	1 940
–	2	11,4	5,9	760 000	1 220 000	7,235	1,531	126 000	890	–
–	2	11,4	5,9	760 000	1 220 000	7,235	1,531	126 000	890	–
–	2	12	5,2	1 020 000	1 590 000	9,241	1,144	157 000	810	–
–	2	12	5,2	1 020 000	1 590 000	9,241	1,144	157 000	810	–
1,9	2,5	13,7	–	830 000	1 080 000	7,191	1,598	126 000	3 050	1 750
1,9	2,5	13,7	–	830 000	1 080 000	7,191	1,598	126 000	3 050	1 750

Toroidal roller bearings

Cylindrical or tapered bore



Cylindrical bore



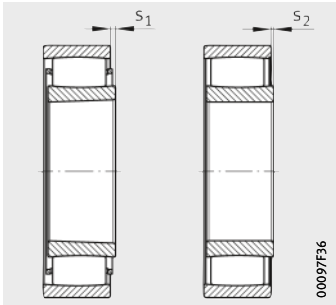
Tapered bore

X-life

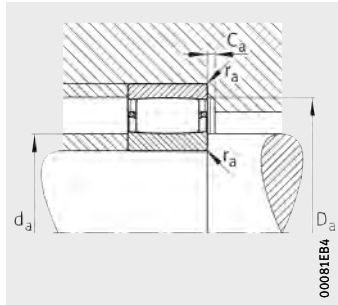
Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions						Mounting dimensions			
	m	d	D	B	r	D_1 ≈	d_2 ≈	D_a		d_a	
	≈ kg				min.			max.	min.	max.	min.
C3030-XL-V	7,6	**150**	225	56	2,1	204,1	173,9	214	–	187	161
C3030-XL-K-M1B	7,4	**150**	225	56	2,1	204,1	173,9	214	199	172,2	161
C3030-XL-K-V	7,4	**150**	225	56	2,1	204,1	173,9	214	–	187	161
C3030-XL-M1B	7,6	**150**	225	56	2,1	204,1	173,9	214	199	172,2	161
C4030-XL-K30-V	9,91	**150**	225	75	2,1	202,2	173,8	214	–	187	161
C4030-XL-V	10,2	**150**	225	75	2,1	202,2	173,8	214	–	187	161
C3130-XL-K	15	**150**	250	80	2,1	225,5	182,5	238	215	197	162
C3130-XL	15,4	**150**	250	80	2,1	225,5	182,5	238	215	197	162
C4130-XL-K30-V	18,8	**150**	250	100	2,1	221,5	179,5	228	–	200	162
C4130-XL-V	19,3	**150**	250	100	2,1	221,5	179,5	228	–	200	162
C2230-XL	17,8	**150**	270	73	3	235,8	177,2	256	220	197	164
C2230-XL-K	17,3	**150**	270	73	3	235,8	177,2	256	220	197	164
C3032-XL	9,26	**160**	240	60	2,1	218,1	186,9	229	212	196	171
C3032-XL-K	9	**160**	240	60	2,1	218,1	186,9	229	212	196	171
C4032-XL-K30-V	12	**160**	240	80	2,1	215,7	182,3	229	–	200	171
C4032-XL-V	12,4	**160**	240	80	2,1	215,7	182,3	229	–	200	171
C3132-XL-K-M1B	19,1	**160**	270	86	2,1	238,2	191,8	258	227	189	172
C3132-XL-M1B	19,6	**160**	270	86	2,1	238,2	191,8	258	227	189	172
C4132-XL-K30-V	24,2	**160**	270	109	2,1	239	192	258	–	215	172
C4132-XL-V	24,9	**160**	270	109	2,1	239	192	258	–	215	172
C3232-XL	29,4	**160**	290	104	3	255,2	194,8	276	239	216	174
C3232-XL-K	28,5	**160**	290	104	3	255,2	194,8	276	239	216	174
C3034-XL	12,5	**170**	260	67	2,1	236,1	200,9	249	229	211	181
C3034-XL-K	12,2	**170**	260	67	2,1	236,1	200,9	249	229	211	181
C4034-XL-K30-V	16,4	**170**	260	90	2,1	233,7	196,3	249	–	222	181
C4034-XL-V	16,8	**170**	260	90	2,1	233,7	196,3	249	–	222	181
C3134-XL-K	20,5	**170**	280	88	2,1	248	201	268	237	216	182
C3134-XL	21	**170**	280	88	2,1	248	201	268	237	216	182
C4134-XL-K30-V	25,4	**170**	280	109	2,1	250,5	200,5	268	–	225	182
C4134-XL-V	26	**170**	280	109	2,1	250,5	200,5	268	–	225	182
C2234-XL	27,9	**170**	310	86	4	273,8	209,2	293	257	231	187
C2234-XL-K	27,1	**170**	310	86	4	273,8	209,2	293	257	231	187

Before ordering, availability for delivery must be checked.



Displacement distance

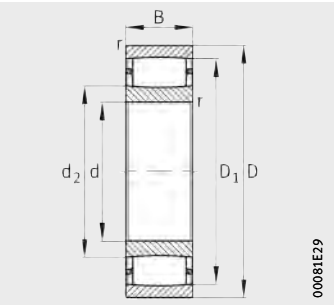


Mounting dimensions

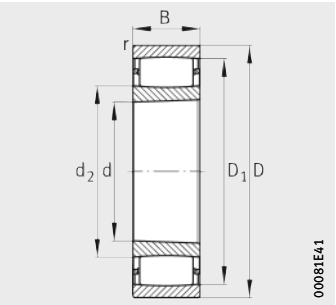
				Basic load ratings		Calculation factors		Fatigue limit load	Limiting speed	Reference speed
C_a	r_a	s_1	s_2	dyn. C	stat. C_0	k_φ	k_δ	C_u	n_G	n_B
min.	max.			N	N			N	min^{-1}	min^{-1}
–	2	14,1	7,3	600 000	960 000	7,535	1,483	114 000	810	–
1,16	2	8,7	–	540 000	850 000	7,535	1,483	101 000	3 400	1 790
–	2	14,1	7,3	600 000	960 000	7,535	1,483	114 000	810	–
1,16	2	8,7	–	540 000	850 000	7,535	1,483	101 000	3 400	1 790
–	2	17,4	10,6	780 000	1 320 000	7,338	1,531	132 000	810	–
–	2	17,4	10,6	780 000	1 320 000	7,338	1,531	132 000	810	–
0,9	2	13,9	–	920 000	1 310 000	9,371	1,15	139 000	3 000	1 610
0,9	2	13,9	–	920 000	1 310 000	9,371	1,15	139 000	3 000	1 610
–	2	20	10,1	1 240 000	1 880 000	10,222	1,03	186 000	710	–
–	2	20	10,1	1 240 000	1 880 000	10,222	1,03	186 000	710	–
2,4	2,5	11,2	–	1 010 000	1 240 000	8,45	1,313	152 000	2 850	1 680
2,4	2,5	11,2	–	1 010 000	1 240 000	8,45	1,313	152 000	2 850	1 680
0,8	2	15	–	610 000	980 000	8,127	1,373	116 000	3 150	1 640
0,8	2	15	–	610 000	980 000	8,127	1,373	116 000	3 150	1 640
–	2	18,1	8,2	910 000	1 470 000	8,521	1,286	158 000	740	–
–	2	18,1	8,2	910 000	1 470 000	8,521	1,286	158 000	740	–
1,73	2	10,3	–	1 010 000	1 410 000	9,469	1,15	147 000	2 800	1 550
1,73	2	10,3	–	1 010 000	1 410 000	9,469	1,15	147 000	2 800	1 550
–	2	21	11,1	1 470 000	2 200 000	10,886	0,969	211 000	630	–
–	2	21	11,1	1 470 000	2 200 000	10,886	0,969	211 000	630	–
2,4	2,5	19,3	–	1 440 000	1 870 000	11,556	0,915	224 000	2 550	1 340
2,4	2,5	19,3	–	1 440 000	1 870 000	11,556	0,915	224 000	2 550	1 340
0,9	2	12,5	–	770 000	1 200 000	7,129	1,672	114 000	2 850	1 480
0,9	2	12,5	–	770 000	1 200 000	7,129	1,672	114 000	2 850	1 480
–	2	17,1	7,2	1 140 000	1 880 000	9,496	1,145	187 000	650	–
–	2	17,1	7,2	1 140 000	1 880 000	9,496	1,145	187 000	650	–
1,7	2	21	–	1 060 000	1 490 000	8,985	1,243	154 000	2 650	1 470
1,7	2	21	–	1 060 000	1 490 000	8,985	1,243	154 000	2 650	1 470
–	2	21	11,1	1 540 000	2 310 000	10,948	0,971	223 000	580	–
–	2	21	11,1	1 540 000	2 310 000	10,948	0,971	223 000	580	–
2,6	3	16,4	–	1 310 000	1 630 000	9,647	1,158	202 000	2 340	1 390
2,6	3	16,4	–	1 310 000	1 630 000	9,647	1,158	202 000	2 340	1 390

Toroidal roller bearings

Cylindrical or tapered bore



Cylindrical bore



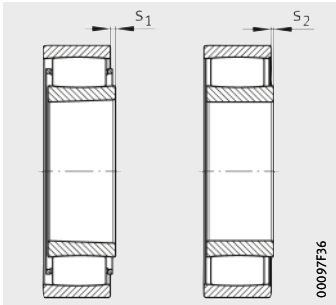
Tapered bore

X-life

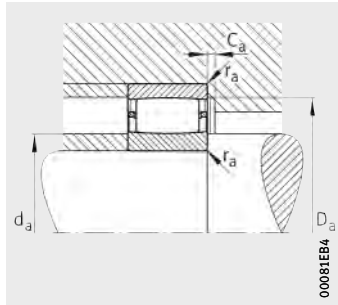
Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions						Mounting dimensions			
	m	d	D	B	r	D_1 ≈	d_2 ≈	D_a		d_a	
	≈ kg				min.			max.	min.	max.	min.
C3036-XL	16,4	**180**	280	74	2,1	251	208,9	269	241	223	191
C3036-XL-K	16	**180**	280	74	2,1	251	208,9	269	241	223	191
C4036-XL-K30-V	21,6	**180**	280	100	2,1	246	204	269	–	230	191
C4036-XL-V	22,2	**180**	280	100	2,1	246	204	269	–	230	191
C3136-XL-K	26	**180**	300	96	3	270,8	215,2	286	257	234	194
C3136-XL	26,7	**180**	300	96	3	270,8	215,2	286	257	234	194
C4136-XL-K30-V	31,9	**180**	300	118	3	264	212	286	–	248	194
C4136-XL-V	32,8	**180**	300	118	3	264	212	286	–	248	194
C3236-XL-K	36,8	**180**	320	112	4	288	229	303	274	248	197
C3236-XL	37,8	**180**	320	112	4	288	229	303	274	248	197
C3038-XL	17,4	**190**	290	75	2,1	266,5	224,5	279	258	237	201
C3038-XL-K	16,9	**190**	290	75	2,1	266,5	224,5	279	258	237	201
C4038-XL-K30-V	22,6	**190**	290	100	2,1	262,5	220,5	279	–	240	201
C4038-XL-V	23,2	**190**	290	100	2,1	262,5	220,5	279	–	240	201
C3138-XL-K	32,4	**190**	320	104	3	288,7	228,3	306	274	248	204
C3138-XL	33,3	**190**	320	104	3	288,7	228,3	306	274	249	204
C4138-XL-K30-V	39,9	**190**	320	128	3	280,5	225,5	306	–	255	204
C4138-XL-V	41	**190**	320	128	3	280,5	225,5	306	–	255	204
C2238-XL	34,4	**190**	340	92	4	296	223,2	323	275	250	207
C2238-XL-K	35,3	**190**	340	92	4	296	223,2	323	275	250	207
C3040-XL	22,2	**200**	310	82	2,1	285,2	234,8	299	272	252	211
C3040-XL-K	21,6	**200**	310	82	2,1	285,2	234,8	299	272	252	211
C4040-XL-K30-V	28,7	**200**	310	109	2,1	278,6	230,4	299	–	255	211
C4040-XL-V	29,5	**200**	310	109	2,1	278,6	230,4	299	–	255	211
C3140-XL-K	39,8	**200**	340	112	3	304,4	245,6	326	290	265	214
C3140-XL	40,8	**200**	340	112	3	304,4	245,6	326	290	265	214
C4140-XL-K30-V	49,7	**200**	340	140	3	300,6	238,4	326	–	270	214
C4140-XL-V	51,1	**200**	340	140	3	300,5	238,5	326	–	270	214

Before ordering, availability for delivery must be checked.



Displacement distance

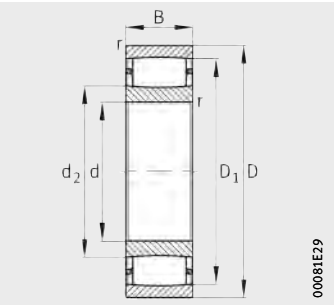


Mounting dimensions

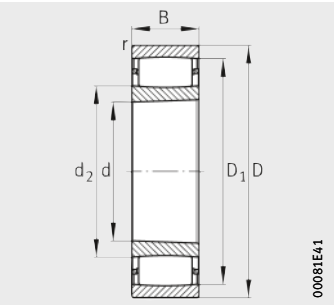
				Basic load ratings		Calculation factors		Fatigue limit load	Limiting speed	Reference speed
C_a	r_a	s_1	s_2	dyn. C	stat. C_0	k_φ	k_δ	C_u	n_G	n_B
min.	max.			N	N			N	min^{-1}	min^{-1}
1,4	2	15,1	–	900 000	1 360 000	9,696	1,136	150 000	2 650	1 420
1,4	2	15,1	–	900 000	1 360 000	9,696	1,136	150 000	2 650	1 420
–	2	20,1	10,2	1 330 000	2 140 000	10,427	1,03	212 000	600	–
–	2	20,1	10,2	1 330 000	2 140 000	10,427	1,03	212 000	600	–
2,1	2,5	23,2	–	1 300 000	1 780 000	9,634	1,162	216 000	2 380	1 310
2,1	2,5	23,2	–	1 300 000	1 780 000	9,634	1,162	216 000	2 380	1 310
–	2,5	20	10,1	1 780 000	2 700 000	11,41	0,935	242 000	530	–
–	2,5	20	10,1	1 780 000	2 700 000	11,41	0,935	242 000	530	–
2,1	3	27,3	–	1 570 000	2 220 000	11,849	0,915	255 000	2 200	1 110
2,1	3	27,3	–	1 570 000	2 220 000	11,849	0,915	255 000	2 200	1 110
1,4	2	16,1	–	940 000	1 480 000	9,831	1,136	161 000	2 450	1 280
1,4	2	16,1	–	940 000	1 480 000	9,831	1,136	161 000	2 450	1 280
–	2	20	10,1	1 370 000	2 330 000	10,571	1,03	221 000	540	–
–	2	20	10,1	1 370 000	2 330 000	10,571	1,03	221 000	540	–
2,3	2,5	19	–	1 540 000	2 240 000	11,767	0,918	205 000	2 220	1 160
2,3	2,5	19	–	1 540 000	2 240 000	11,767	0,918	205 000	2 220	1 160
–	2,5	20	10,1	2 060 000	3 200 000	12,252	0,868	270 000	485	–
–	2,5	20	10,1	2 060 000	3 200 000	12,252	0,868	270 000	485	–
3	3	22,5	–	1 430 000	1 760 000	9,695	1,176	217 000	2 130	1 310
3	3	22,5	–	1 430 000	1 760 000	9,695	1,176	217 000	2 130	1 310
1,6	2	15,2	–	1 170 000	1 760 000	10,083	1,117	181 000	2 250	1 180
1,6	2	15,2	–	1 170 000	1 760 000	10,083	1,117	181 000	2 250	1 180
–	2	21	11,1	1 650 000	2 650 000	11,664	0,924	265 000	490	–
–	2	21	11,1	1 650 000	2 650 000	11,664	0,924	265 000	490	–
2,1	2,5	27,3	–	1 600 000	2 330 000	11,861	0,923	265 000	2 060	1 120
2,1	2,5	27,3	–	1 600 000	2 330 000	11,861	0,923	265 000	2 060	1 120
–	2,5	22	12,1	2 400 000	3 700 000	14,02	0,747	315 000	435	–
–	2,5	22	12,1	2 400 000	3 700 000	13,961	0,752	365 000	435	–

Toroidal roller bearings

Cylindrical or tapered bore



Cylindrical bore



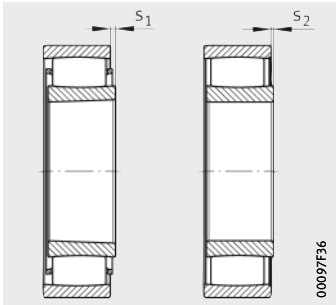
Tapered bore

X-life

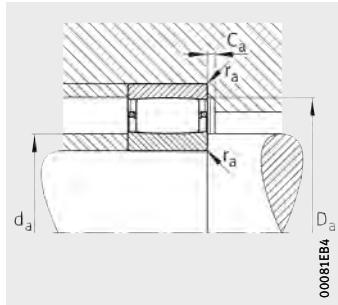
Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions						Mounting dimensions			
	m	d	D	B	r	D_1 ≈	d_2 ≈	D_a		d_a	
	≈ kg				min.			max.	min.	max.	min.
C3044-XL-K	28,4	**220**	340	90	3	310	256,7	327	297	274	233
C3044-XL	29,2	**220**	340	90	3	310	256,7	327	297	274	233
C4044-XL-K30-V	37,3	**220**	340	118	3	304,1	252,9	327	–	280	233
C4044-XL-V	38,3	**220**	340	118	3	304,1	252,9	327	–	280	233
C3144-XL-K	49,9	**220**	370	120	4	333,1	269,2	353	316	291	237
C3144-XL	51,3	**220**	370	120	4	333,1	269,2	353	316	291	237
C2244-XL	58,2	**220**	400	108	4	351,1	257,9	383	323	292	237
C2244-XL-K	56,7	**220**	400	108	4	351,1	257,9	383	323	292	237
C3048-XL-K	31,1	**240**	360	92	3	329,2	275,8	347	316	293	253
C3048-XL	32	**240**	360	92	3	329,2	275,8	347	316	293	253
C3148-XL-K	61,6	**240**	400	128	4	365,8	281,2	383	337	307	257
C3148-XL	63,2	**240**	400	128	4	356,8	281,2	383	337	307	257
C3052-XL-K	45,2	**260**	400	104	4	366,1	305,8	385	351	326	275
C3052-XL	46,4	**260**	400	104	4	366,1	305,8	385	351	326	275
C3152-XL-K	85,3	**260**	440	144	4	397	318,9	423	377	346	277
C3152-XL	87,5	**260**	440	144	4	397	318,9	423	377	346	277
C3056-XL-K	48,8	**280**	420	106	4	388,5	328,5	405	374	348	295
C3056-XL	50,1	**280**	420	106	4	388,5	328,5	405	374	348	295
C3156-XL	93,8	**280**	460	146	5	415	337	440	394	364	300
C3156-XL-K	91,4	**280**	460	146	5	415	337	440	394	364	300
C3060-XL-K-M	67,4	**300**	460	118	4	416	353	445	400	369	315
C3060-XL-M	69,2	**300**	460	118	4	416	353	445	400	369	315
C4060-XL-K30-M1B	91,4	**300**	460	160	4	404,8	343,2	445	392	357	315
C4060-XL-M1B	93,9	**300**	460	160	4	404,8	343,2	445	392	357	315
C3160-XL-K	120	**300**	500	160	5	447,6	362,4	480	426	391	320
C3160-XL	124	**300**	500	160	5	447,6	362,4	480	426	391	320
C4160-XL-K30-M1B	150	**300**	500	200	5	446,1	355,9	480	425	352	320
C4160-XL-M1B	154	**300**	500	200	5	446,1	355,9	480	425	352	320

Before ordering, availability for delivery must be checked.



Displacement distance

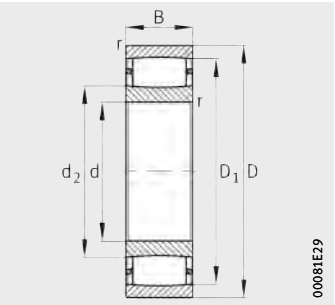


Mounting dimensions

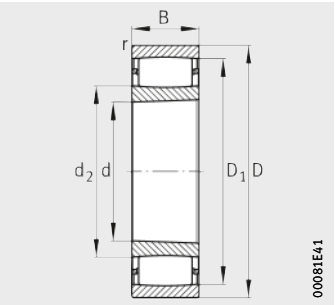
				Basic load ratings		Calculation factors		Fatigue limit load	Limiting speed	Reference speed
C_a	r_a	s_1	s_2	dyn. C	stat. C_0	k_φ	k_δ	C_u	n_G	n_B
min.	max.			N	N			N	min^{-1}	min^{-1}
1,7	2,5	17,2	–	1 370 000	2 130 000	11,851	0,931	221 000	2 030	1 050
1,7	2,5	17,2	–	1 370 000	2 130 000	11,851	0,931	221 000	2 030	1 050
–	2,5	20	10,1	1 960 000	3 250 000	11,548	0,957	285 000	425	–
–	2,5	20	10,1	1 960 000	3 250 000	11,548	0,957	285 000	425	–
1,4	3	22,3	–	1 930 000	2 900 000	13,667	0,791	280 000	1 850	960
1,4	3	22,3	–	1 930 000	2 900 000	13,667	0,791	280 000	1 850	960
3,9	3	20,5	–	2 080 000	2 550 000	11,976	0,937	300 000	1 720	1 050
3,9	3	20,5	–	2 080 000	2 550 000	11,976	0,937	300 000	1 720	1 050
1,7	2,5	19,2	–	1 400 000	2 230 000	12,016	0,931	228 000	1 880	980
1,7	2,5	19,2	–	1 400 000	2 230 000	12,016	0,931	228 000	1 880	980
2,9	3	20,4	–	2 380 000	3 500 000	14,559	0,741	370 000	1 690	870
2,9	3	20,4	–	2 380 000	3 500 000	14,559	0,741	370 000	1 690	870
1,9	3	19,3	–	1 830 000	2 950 000	12,381	0,924	280 000	1 650	830
1,9	3	19,3	–	1 830 000	2 950 000	12,381	0,924	280 000	1 650	830
1,7	3	26,4	–	2 750 000	4 250 000	16,223	0,667	435 000	1 480	740
1,7	3	26,4	–	2 750 000	4 250 000	16,223	0,667	435 000	1 480	740
1,9	3	21,3	–	1 870 000	3 100 000	12,577	0,924	290 000	1 530	770
1,9	3	21,3	–	1 870 000	3 100 000	12,577	0,924	290 000	1 530	770
1,7	4	28,4	–	2 850 000	4 500 000	16,385	0,666	455 000	1 400	700
1,7	4	28,4	–	2 850 000	4 500 000	16,385	0,666	455 000	1 400	700
1,6	3	20	–	2 220 000	3 800 000	14,109	0,812	330 000	1 400	690
1,6	3	20	–	2 220 000	3 800 000	14,109	0,812	330 000	1 400	690
0,71	3	16	–	2 650 000	4 550 000	16,395	0,665	420 000	1 440	600
0,71	3	16	–	2 650 000	4 550 000	16,395	0,665	420 000	1 440	600
1,9	4	30,5	–	3 350 000	5 300 000	17,019	0,647	510 000	1 280	630
1,9	4	30,5	–	3 350 000	5 300 000	17,019	0,647	510 000	1 280	630
4,2	4	14,9	–	4 150 000	6 800 000	27,776	0,359	670 000	1 280	495
4,2	4	14,9	–	4 150 000	6 800 000	27,776	0,359	670 000	1 280	495

Toroidal roller bearings

Cylindrical or tapered bore



Cylindrical bore



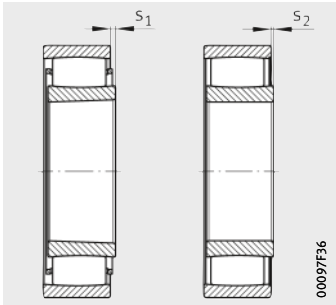
Tapered bore

X-life

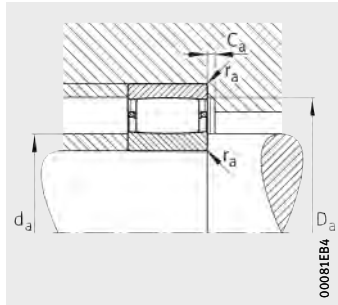
Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions						Mounting dimensions			
	m	d	D	B	r	D_1 ≈	d_2 ≈	D_a		d_a	
	≈ kg				min.			max.	min.	max.	min.
C3064-XL-M	74,7	**320**	480	121	4	439,4	376,6	465	423	393	335
C3064-XL-K-M	72,8	**320**	480	121	4	439,4	376,6	465	423	393	335
C3164-XL-M	157	**320**	540	176	5	475,9	372,1	520	448	400	340
C3164-XL-K-M	157	**320**	540	176	5	475,9	372,1	520	448	400	340
C3068-XL-M	99,3	**340**	520	133	5	481,7	402,3	502	460	424	358
C3068-XL-K-M	96,8	**340**	520	133	5	481,7	402,3	502	460	424	358
C3168-XL-M	202	**340**	580	190	5	517,6	404,4	560	485	437	360
C3168-XL-K-M	197	**340**	580	190	5	517,6	404,4	560	485	437	360
C3972-XL-K-M	42,6	**360**	480	90	3	450,6	393,4	467	437	408	373
C3972-XL-M	43,8	**360**	480	90	3	450,6	393,4	467	437	408	373
C3072-XL-M	105	**360**	540	134	5	496,6	417,4	522	475	439	378
C3072-XL-K-M	102	**360**	540	134	5	496,6	417,4	522	475	439	378
C3172-XL-M	213	**360**	600	192	5	542,7	427,2	580	509	461	380
C3172-XL-K-M	208	**360**	600	192	5	542,7	427,2	580	509	461	380
C3976-XL-K-M	62,8	**380**	520	106	4	489,1	427,9	505	474	444	395
C3976-XL-M	64,4	**380**	520	106	4	489,1	427,9	505	474	444	395
C3076-XL-M	110	**380**	560	135	5	510,5	431,5	542	489	453	398
C3076-XL-K-M	107	**380**	560	135	5	510,5	431,5	542	489	453	398
C3176-XL-M	225	**380**	620	194	5	548,6	448,4	600	523	474	400
C3176-XL-K-M	219	**380**	620	194	5	548,6	448,4	600	523	474	400
C3980-XL-K-M	65,6	**400**	540	106	4	500,6	439,4	525	485	456	415
C3980-XL-M	67,3	**400**	540	106	4	500,6	439,4	525	485	456	415
C3080-XL-M	143	**400**	600	148	5	553	458	582	527	484	418
C3080-XL-K-M	139	**400**	600	148	5	553	458	582	527	484	418
C3180-XL-M	253	**400**	650	200	6	586,1	490,9	624	563	514	426
C3180-XL-K-M	247	**400**	650	200	6	586,1	490,9	624	563	514	426
C3984-XL-K-M	68,4	**420**	560	106	4	518,6	457,4	545	503	474	435
C3984-XL-M	70,2	**420**	560	106	4	518,6	457,4	545	503	474	435
C3084-XL-M	151	**420**	620	150	5	569,8	475,2	602	544	501	438
C3084-XL-K-M	147	**420**	620	150	5	569,8	475,2	602	544	501	438
C3184-XL-M	339	**420**	700	224	6	615,7	510,3	674	587	539	446
C3184-XL-K-M	330	**420**	700	224	6	615,7	510,3	674	587	539	446

Before ordering, availability for delivery must be checked.



Displacement distance

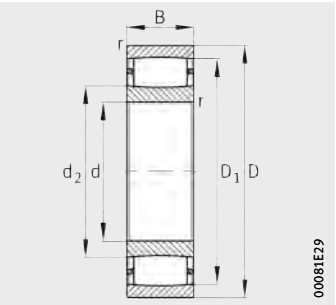


Mounting dimensions

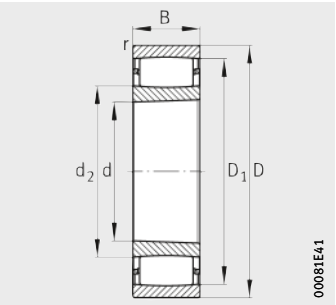
				Basic load ratings		Calculation factors		Fatigue limit load	Limiting speed	Reference speed
C_a	r_a	s_1	s_2	dyn. C	stat. C_0	k_φ	k_δ	C_u	n_G	n_B
min.	max.			N	N			N	min^{-1}	min^{-1}
1,6	3	23,3	–	2 300 000	4 100 000	15,05	0,76	365 000	1 310	640
1,6	3	23,3	–	2 300 000	4 100 000	15,05	0,76	365 000	1 310	640
4	4	26,7	–	4 150 000	6 300 000	19,823	0,542	610 000	1 180	590
4	4	26,7	–	4 150 000	6 300 000	19,823	0,542	610 000	1 180	590
2,5	4	25,4	–	2 950 000	4 950 000	15,578	0,745	460 000	1 170	560
2,5	4	25,4	–	2 950 000	4 950 000	15,578	0,745	460 000	1 170	560
2,7	4	25,9	–	4 900 000	7 500 000	22,159	0,481	710 000	1 060	510
2,7	4	25,9	–	4 900 000	7 500 000	22,159	0,481	710 000	1 060	510
2,1	2,5	17,2	–	1 770 000	3 250 000	13,126	0,925	360 000	1 280	600
2,1	2,5	17,2	–	1 770 000	3 250 000	13,126	0,925	360 000	1 280	600
2,5	4	26,4	–	2 950 000	5 000 000	15,709	0,745	460 000	1 120	550
2,5	4	26,4	–	2 950 000	5 000 000	15,709	0,745	460 000	1 120	550
2,7	4	27,9	–	5 100 000	8 000 000	25,896	0,403	750 000	1 020	485
2,7	4	27,9	–	5 100 000	8 000 000	25,896	0,403	750 000	1 020	485
2,2	3	21	–	2 130 000	4 000 000	14,746	0,813	405 000	1 150	550
2,2	3	21	–	2 130 000	4 000 000	14,746	0,813	405 000	1 150	550
2,5	4	27	–	3 050 000	5 200 000	15,827	0,745	475 000	1 090	530
2,5	4	27	–	3 050 000	5 200 000	15,827	0,745	475 000	1 090	530
2,1	4	25,4	–	5 000 000	8 500 000	20,403	0,544	720 000	990	455
2,1	4	25,4	–	5 000 000	8 500 000	20,403	0,544	720 000	990	455
2,2	3	21	–	2 170 000	4 150 000	14,846	0,813	415 000	1 120	530
2,2	3	21	–	2 170 000	4 150 000	14,846	0,813	415 000	1 120	530
3	4	30,6	–	3 750 000	6 200 000	17,429	0,671	560 000	980	475
3	4	30,6	–	3 750 000	6 200 000	17,429	0,671	560 000	980	475
1,8	5	50,7	–	4 800 000	8 300 000	20,809	0,542	750 000	910	435
1,8	5	50,7	–	4 800 000	8 300 000	20,809	0,542	750 000	910	435
2,2	3	21,3	–	2 200 000	4 250 000	15,003	0,813	425 000	1 070	510
2,2	3	21,3	–	2 200 000	4 250 000	15,003	0,813	425 000	1 070	510
3	4	32,6	–	3 800 000	6 400 000	17,577	0,671	580 000	950	460
3	4	32,6	–	3 800 000	6 400 000	17,577	0,671	580 000	950	460
1,9	5	34,8	–	6 000 000	10 600 000	24,992	0,435	890 000	860	390
1,9	5	34,8	–	6 000 000	10 600 000	24,992	0,435	890 000	860	390

Toroidal roller bearings

Cylindrical or tapered bore



Cylindrical bore



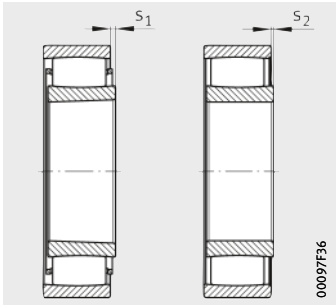
Tapered bore

X-life

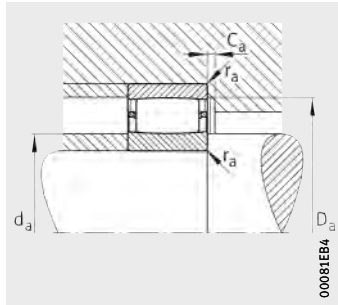
Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions						Mounting dimensions			
	m	d	D	B	r	D_1 ≈	d_2 ≈	D_a		d_a	
	≈ kg				min.			max.	min.	max.	min.
C3988-XL-K-M	92,3	**440**	600	118	4	559,5	494,5	585	545	517	455
C3988-XL-M	94,7	**440**	600	118	4	559,5	494,5	585	545	517	455
C3088-XL-K-M1B	169	**440**	650	157	6	583,7	491,9	627	566	489	463
C3088-XL-M1B	173	**440**	650	157	6	583,7	494,3	627	566	489	463
C3188-XL-K-M1B	345	**440**	720	226	6	646,2	521,1	694	615	518	466
C3188-XL-M1B	354	**440**	720	226	6	646,2	521,1	694	615	518	466
C4188-XL-K30-M1B	427	**440**	720	280	6	634,4	512,6	694	608	506	466
C4188-XL-M1B	439	**440**	720	280	6	634,4	512,6	694	608	506	466
C3992-XL-K-M	95,8	**460**	620	118	4	574	509	605	561	504	467
C3992-XL-M	98,4	**460**	620	118	4	574	509	605	561	504	467
C3092-XL-M	197	**460**	680	163	6	623,7	539,2	654	603	560	486
C3092-XL-K-M	192	**460**	680	163	6	623,7	539,2	654	603	560	486
C3192-XL-M	424	**460**	760	240	7,5	679,2	558,8	728	649	589	492
C3192-XL-K-M	413	**460**	760	240	7,5	679,2	558,8	728	649	589	492
C4192-XL-K30-M1B	516	**460**	760	300	7,5	668,3	539,6	728	634	588	477
C4192-XL-M1B	530	**460**	760	300	7,5	668,3	539,6	728	634	588	477
C3996-XL-K-M	116	**480**	650	128	5	607,6	525,4	632	588	555	498
C3996-XL-M	119	**480**	650	128	5	607,6	525,4	632	588	555	498
C3096-XL-M	207	**480**	700	165	6	639,5	555,5	677	619	576	503
C3096-XL-K-M	201	**480**	700	165	6	639,5	555,5	677	619	576	503
C3196-XL-K-M1B	459	**480**	790	248	7,5	697,4	577,1	758	676	574	512
C3196-XL-M1B	471	**480**	790	248	7,5	697,4	577,1	758	676	574	512
C39/500-XL-K-M	120	**500**	670	128	5	634,6	552,4	652	615	573	518
C39/500-XL-M	123	**500**	670	128	5	634,6	552,4	652	615	573	518
C30/500-XL-M	216	**500**	720	167	6	655,8	572,2	697	635	593	523
C30/500-XL-K-M	211	**500**	720	167	6	655,8	572,2	697	635	593	523
C31/500-XL-K-M	545	**500**	830	264	7,5	734,2	608,8	798	702	641	532
C31/500-XL-M	559	**500**	830	264	7,5	734,2	608,8	798	702	641	532
C41/500-XL-K30-M1B	670	**500**	830	325	7,5	739,2	598,7	798	708	594	532
C41/500-XL-M1B	688	**500**	830	325	7,5	739,2	598,7	798	708	594	532

Before ordering, availability for delivery must be checked.



Displacement distance

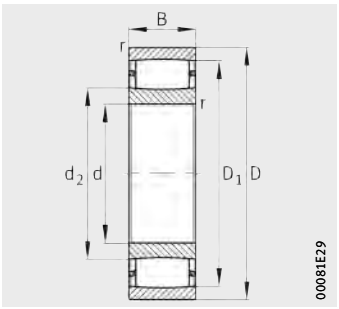


Mounting dimensions

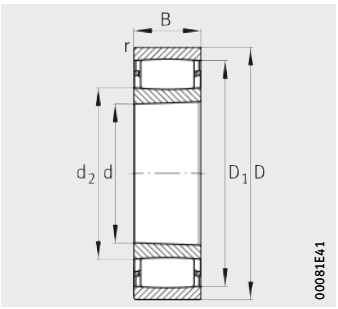
				Basic load ratings		Calculation factors		Fatigue limit load	Limiting speed	Reference speed
C_a	r_a	s_1	s_2	dyn. C	stat. C_0	k_φ	k_δ	C_u	n_G	n_B
min.	max.			N	N			N	min^{-1}	min^{-1}
1,4	3	20	–	2 650 000	5 300 000	16,524	0,732	490 000	970	445
1,4	3	20	–	2 650 000	5 300 000	16,524	0,732	490 000	970	445
5,5	5	19,7	–	3 750 000	6 500 000	18,096	0,652	570 000	920	460
5,5	5	19,7	–	3 750 000	6 500 000	18,096	0,652	570 000	920	460
6,3	5	16	–	6 900 000	11 600 000	25,092	0,347	960 000	810	360
6,3	5	16	–	6 900 000	11 600 000	25,092	0,347	960 000	810	360
6,5	5	27,8	–	7 600 000	12 900 000	29,46	0,357	1 060 000	820	305
6,5	5	27,8	–	7 600 000	12 900 000	29,46	0,357	1 060 000	820	305
1,4	3	20	–	2 750 000	5 600 000	16,651	0,732	510 000	940	425
1,4	3	20	–	2 750 000	5 600 000	16,651	0,732	510 000	940	425
2,2	5	33,5	–	4 000 000	7 500 000	18,559	0,647	640 000	850	400
2,2	5	33,5	–	4 000 000	7 500 000	18,559	0,647	640 000	850	400
2,1	6	51	–	6 800 000	12 000 000	25,204	0,441	1 010 000	760	350
2,1	6	51	–	6 800 000	12 000 000	25,204	0,441	1 010 000	760	350
6,9	6	23,3	–	8 700 000	14 900 000	32,219	0,324	1 190 000	770	280
6,9	6	23,3	–	8 700 000	14 900 000	32,219	0,324	1 190 000	770	280
3,1	4	20,4	–	3 300 000	6 200 000	19,501	0,6	610 000	880	405
3,1	4	20,4	–	3 300 000	6 200 000	19,501	0,6	610 000	880	405
2,2	5	35,5	–	4 100 000	7 800 000	18,699	0,647	660 000	820	390
2,2	5	35,5	–	4 100 000	7 800 000	18,699	0,647	660 000	820	390
6,1	6	35,1	–	7 100 000	12 600 000	25,47	0,439	1 050 000	730	335
6,1	6	35,1	–	7 100 000	12 600 000	25,47	0,439	1 050 000	730	335
3,1	4	20,4	–	3 350 000	6 500 000	19,736	0,6	620 000	830	375
3,1	4	20,4	–	3 350 000	6 500 000	19,736	0,6	620 000	830	375
2,1	5	37,5	–	4 300 000	8 300 000	18,843	0,647	700 000	790	370
2,1	5	37,5	–	4 300 000	8 300 000	18,843	0,647	700 000	790	370
4,4	6	75,3	–	7 500 000	12 900 000	25,64	0,441	1 090 000	680	330
4,4	6	75,3	–	7 500 000	12 900 000	25,64	0,441	1 090 000	680	330
7,5	6	15	–	10 700 000	19 100 000	36,213	0,287	1 410 000	680	225
7,5	6	15	–	10 700 000	19 100 000	36,213	0,287	1 410 000	680	225

Toroidal roller bearings

Cylindrical or tapered bore



Cylindrical bore



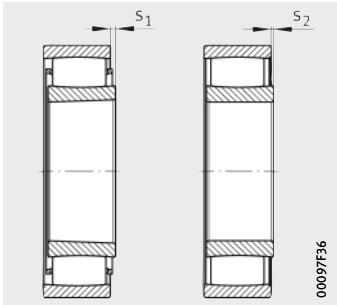
Tapered bore

X-life

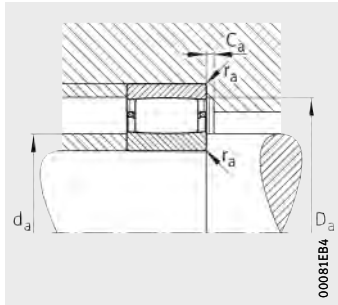
Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions						Mounting dimensions			
	m	d	D	B	r	D_1 ≈	d_2 ≈	D_a		d_a	
	≈ kg				min.			max.	min.	max.	min.
C39/530-XL-K-M	143	**530**	710	136	5	658	577	692	639	606	548
C39/530-XL-M	146	**530**	710	136	5	658	577	692	639	606	548
C30/530-XL-M	292	**530**	780	185	6	702,9	602,1	757	677	628	553
C30/530-XL-K-M	285	**530**	780	185	6	702,9	602,1	757	677	628	553
C31/530-XL-M	625	**530**	870	272	7,5	779,2	636,8	838	738	678	562
C31/530-XL-K-M	609	**530**	870	272	7,5	779,2	636,8	838	738	678	562
C39/560-XL-K-M	164	**560**	750	140	5	701,7	621,3	732	683	650	578
C39/560-XL-M	168	**560**	750	140	5	701,7	621,3	732	683	650	578
C30/560-XL-M	338	**560**	820	195	6	758,9	662,1	793	735	686	583
C30/560-XL-K-M	329	**560**	820	195	6	758,9	662,1	793	735	686	583
C31/560-XL-K-M1B	701	**560**	920	280	7,5	805,2	663,4	888	778	660	592
C31/560-XL-M1B	720	**560**	920	280	7,5	805,2	663,4	888	778	660	592
C39/600-XL-K-M	197	**600**	800	150	5	745,3	664,7	782	726	685	618
C39/600-XL-M	203	**600**	800	150	5	745,3	664,7	782	726	685	618
C30/600-XL-M	383	**600**	870	200	6	805,6	691,4	847	773	724	623
C30/600-XL-K-M	373	**600**	870	200	6	805,6	691,4	847	773	724	623
C31/600-XL-K-M1B	847	**600**	980	300	7,5	869,9	702,9	948	837	699	632
C31/600-XL-M1B	869	**600**	980	300	7,5	869,9	702,9	948	837	699	632
C41/600-XL-K30-M1B	1 058	**600**	980	375	7,5	864,7	701,2	948	828	695	632
C41/600-XL-M1B	1 086	**600**	980	375	7,5	864,7	701,2	948	828	695	632
C39/630-XL-K-M	253	**630**	850	165	6	790,8	693,2	827	766	729	653
C39/630-XL-M	259	**630**	850	165	6	790,8	693,2	827	766	729	653
C30/630-XL-M	460	**630**	920	212	7,5	841,7	715,2	892	809	748	658
C30/630-XL-K-M	448	**630**	920	212	7,5	841,7	715,2	892	809	748	658
C31/630-XL-K-M1B	983	**630**	1 030	315	7,5	910,9	743,4	998	878	739	662
C31/630-XL-M1B	1 009	**630**	1 030	315	7,5	910,9	743,4	998	878	739	662
C39/670-XL-K-M	289	**670**	900	170	6	852,8	756,2	877	833	749	693
C39/670-XL-M	296	**670**	900	170	6	852,8	756,2	877	833	749	693
C30/670-XL-M	568	**670**	980	230	7,5	902,3	776,7	952	870	809	698
C30/670-XL-K-M	553	**670**	980	230	7,5	902,3	776,7	952	870	809	698
C31/670-XL-K-M1B	1 167	**670**	1 090	336	7,5	963,7	786	1 058	930	782	702
C31/670-XL-M1B	1 198	**670**	1 090	336	7,5	963,7	786	1 058	930	782	702

Before ordering, availability for delivery must be checked.



Displacement distance

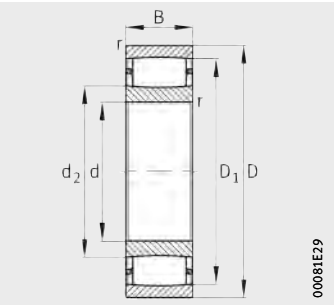


Mounting dimensions

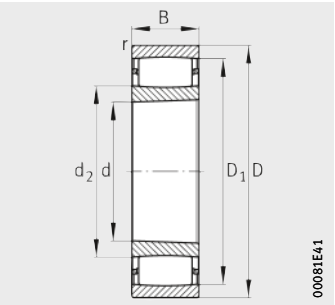
				Basic load ratings		Calculation factors		Fatigue limit load	Limiting speed	Reference speed
C_a	r_a	s_1	s_2	dyn. C	stat. C_0	k_φ	k_δ	C_u	n_G	n_B
min.	max.			N	N			N	min^{-1}	min^{-1}
2,9	4	28,4	–	3 550 000	7 100 000	19,946	0,6	670 000	790	365
2,9	4	28,4	–	3 550 000	7 100 000	19,946	0,6	670 000	790	365
2,5	5	35,7	–	5 200 000	9 700 000	21,626	0,548	790 000	730	340
2,5	5	35,7	–	5 200 000	9 700 000	21,626	0,548	790 000	730	340
3	6	44,4	–	9 100 000	16 100 000	30,734	0,356	1 310 000	640	280
3	6	44,4	–	9 100 000	16 100 000	30,734	0,356	1 310 000	640	280
2,9	4	32,4	–	3 650 000	7 500 000	20,33	0,6	700 000	730	335
2,9	4	32,4	–	3 650 000	7 500 000	20,33	0,6	700 000	730	335
2,4	5	45,7	–	5 700 000	11 200 000	22,141	0,548	890 000	660	295
2,4	5	45,7	–	5 700 000	11 200 000	22,141	0,548	890 000	660	295
7,3	6	28	–	9 600 000	17 400 000	30,983	0,355	1 350 000	610	265
7,3	6	28	–	9 600 000	17 400 000	30,983	0,355	1 350 000	610	265
1,7	4	32,4	–	4 100 000	8 800 000	21,712	0,561	790 000	680	305
1,7	4	32,4	–	4 100 000	8 800 000	21,712	0,561	790 000	680	305
2	5	35,9	–	6 300 000	12 200 000	28,196	0,403	970 000	620	275
2	5	35,9	–	6 300 000	12 200 000	28,196	0,403	970 000	620	275
8,8	6	26,1	–	11 100 000	19 100 000	30,953	0,363	1 490 000	550	247
8,8	6	26,1	–	11 100 000	19 100 000	30,953	0,363	1 490 000	550	247
9	6	24,6	–	13 600 000	24 500 000	40,44	0,26	1 780 000	560	186
9	6	24,6	–	13 600 000	24 500 000	40,44	0,26	1 780 000	560	186
3,6	5	35,5	–	5 000 000	10 100 000	22,766	0,536	890 000	630	285
3,6	5	35,5	–	5 000 000	10 100 000	22,766	0,536	890 000	630	285
3,9	6	48,1	–	6 900 000	12 900 000	29,154	0,39	1 050 000	580	270
3,9	6	48,1	–	6 900 000	12 900 000	29,154	0,39	1 050 000	580	270
8,8	6	23,8	–	12 200 000	22 000 000	34,168	0,324	1 660 000	520	222
8,8	6	23,8	–	12 200 000	22 000 000	34,168	0,324	1 660 000	520	222
2,1	5	24,9	–	5 700 000	12 300 000	24,732	0,493	1 020 000	570	237
2,1	5	24,9	–	5 700 000	12 300 000	24,732	0,493	1 020 000	570	237
3,1	6	41,1	–	8 300 000	16 500 000	27,163	0,44	1 250 000	530	226
3,1	6	41,1	–	8 300 000	16 500 000	27,163	0,44	1 250 000	530	226
12	6	41	–	12 600 000	22 300 000	34,543	0,325	1 740 000	490	220
12	6	41	–	12 600 000	22 300 000	34,543	0,325	1 740 000	490	220

Toroidal roller bearings

Cylindrical or tapered bore



Cylindrical bore



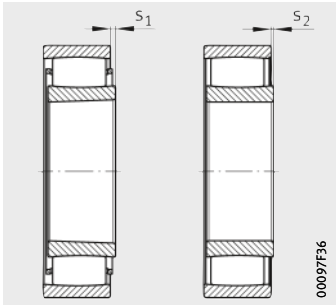
Tapered bore

X-life

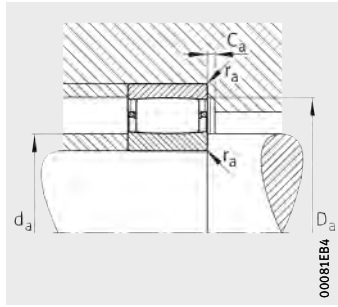
Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions						Mounting dimensions			
	m	d	D	B	r	D_1 ≈	d_2 ≈	D_a		d_a	
	≈ kg				min.			max.	min.	max.	min.
C39/710-XL-K-M	337	**710**	950	180	6	877,4	772,6	927	849	802	733
C39/710-XL-M	346	**710**	950	180	6	877,4	772,6	927	849	802	733
C30/710-XL-M	634	**710**	1 030	236	7,5	943,3	808,7	1 002	906	846	738
C30/710-XL-K-M	618	**710**	1 030	236	7,5	943,3	808,7	1 002	906	846	738
C40/710-XL-M1B	846	**710**	1 030	315	7,5	931,2	806,8	1 002	899	841	738
C40/710-XL-K30-M1B	824	**710**	1 030	315	7,5	931,2	806,8	1 002	899	841	738
C31/710-XL-K-M1B	1 327	**710**	1 150	345	9,5	1 005,3	843,3	1 100	976	839	750
C31/710-XL-M1B	1 362	**710**	1 150	345	9,5	1 005,3	843,3	1 100	976	839	750
C39/750-XL-K-M	380	**750**	1 000	185	6	933,5	829,5	977	906	869	773
C39/750-XL-M	391	**750**	1 000	185	6	933,5	829,5	977	906	869	773
C30/750-XL-K-M1B	735	**750**	1 090	250	7,5	991,7	856,3	1 062	965	852	778
C30/750-XL-M1B	755	**750**	1 090	250	7,5	991,7	856,3	1 062	965	852	778
C39/800-XL-K-M	443	**800**	1 060	195	6	990,6	888,4	1 037	970	879	823
C39/800-XL-M	455	**800**	1 060	195	6	990,6	888,4	1 037	970	879	823
C30/800-XL-K-M1B	828	**800**	1 150	258	7,5	1 045,4	911,5	1 122	1 020	906	828
C30/800-XL-M1B	828	**800**	1 150	258	7,5	1 045,4	911,5	1 122	1 020	906	828
C39/850-XL-K-M	500	**850**	1 120	200	6	1 056,9	936,1	1 097	1 027	981	873
C39/850-XL-M	513	**850**	1 120	200	6	1 056,9	936,1	1 097	1 027	981	873
C39/900-XL-K-M	564	**900**	1 180	206	6	1 114,6	987,4	1 157	1 087	981	923
C39/900-XL-M	579	**900**	1 180	206	6	1 114,6	987,4	1 157	1 087	981	923

Before ordering, availability for delivery must be checked.



Displacement distance



Mounting dimensions

				Basic load ratings		Calculation factors		Fatigue limit load	Limiting speed	Reference speed
C_a	r_a	s_1	s_2	dyn. C	stat. C_0	k_φ	k_δ	C_u	n_G	n_B
min.	max.			N	N			N	min^{-1}	min^{-1}
6,5	5	30,7	–	6 100 000	12 900 000	25,417	0,479	1 040 000	550	237
6,5	5	30,7	–	6 100 000	12 900 000	25,417	0,479	1 040 000	550	237
4,3	6	47,3	–	9 000 000	17 600 000	27,717	0,435	1 360 000	500	214
4,3	6	47,3	–	9 000 000	17 600 000	27,717	0,435	1 360 000	500	214
1,3	6	31,5	–	10 300 000	21 100 000	34,772	0,321	1 560 000	510	176
1,3	6	31,5	–	10 300 000	21 100 000	34,772	0,321	1 560 000	510	176
8,7	8	47,8	–	12 700 000	24 200 000	35,044	0,324	1 810 000	465	203
8,7	8	47,8	–	12 700 000	24 200 000	35,044	0,324	1 810 000	465	203
3,8	5	35,7	–	6 400 000	14 000 000	25,91	0,479	1 120 000	510	216
3,8	5	35,7	–	6 400 000	14 000 000	25,91	0,479	1 120 000	510	216
6,9	6	25	–	9 500 000	19 300 000	29,669	0,404	1 430 000	475	201
6,9	6	25	–	9 500 000	19 300 000	29,669	0,404	1 430 000	475	201
3,6	5	45,7	–	6 600 000	14 800 000	26,416	0,479	1 160 000	475	205
3,6	5	45,7	–	6 600 000	14 800 000	26,416	0,479	1 160 000	475	205
6,9	6	25	–	9 600 000	20 100 000	30,144	0,404	1 470 000	445	191
6,9	6	25	–	9 600 000	20 100 000	30,144	0,404	1 470 000	445	191
4,5	5	35,9	–	7 800 000	17 000 000	30,626	0,398	1 390 000	440	182
4,5	5	35,9	–	7 800 000	17 000 000	30,626	0,398	1 390 000	440	182
3	5	20	–	9 000 000	20 300 000	32,311	0,377	1 570 000	410	159
3	5	20	–	9 000 000	20 300 000	32,311	0,377	1 570 000	410	159

Application example
Paper industry

In the dry section of a paper machine, the still damp paper web is fed over steam-heated rolls for final drying. The bearings in these dryer rolls run under high ambient temperatures in housings with recirculating oil lubrication, *Figure 1*.

Figure 1
Dryer roll in a paper machine

Requirements

The requirements placed on the bearing arrangement are:

- constraint-free compensation in the non-locating bearing of substantial changes in the axial length of the roll
- compensation of possible angular defects in the locating bearing and non-locating bearing
- resistance to substantial differences in temperature
- very high operational reliability of the bearing arrangement ($L_{hmn} > 100\,000$ h).

Schaeffler offers specially developed housings for this application. Further information on the housings is available on request.

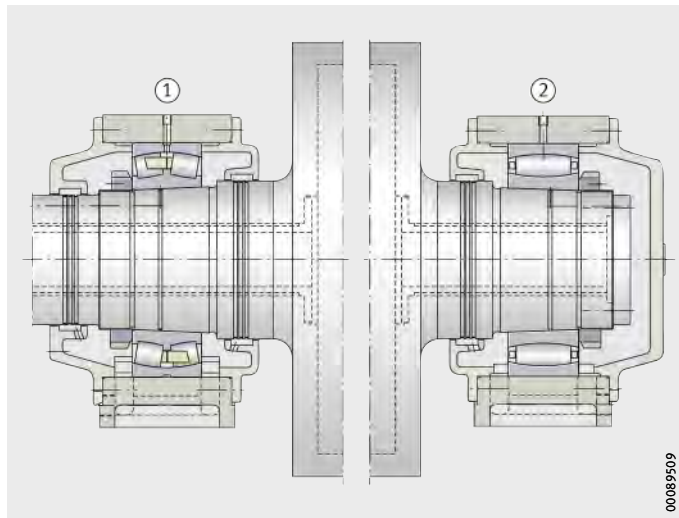
Design solution

The locating bearing side (drive side) is fitted with a spherical roller bearing, while the non-locating bearing arrangement is fitted with a toroidal roller bearing, *Figure 2*.

Both bearings are sufficiently suitable for supporting any possible angular defects. Due to the robust design and load carrying capacity of these bearings, the required calculated rating life is achieved without difficulty, since the bearing sizes are partially specified by the hollow journal of the rolls.

The two bearing types have metal cages as are required in the paper industry. With the resulting bearing size, the toroidal roller bearing on the non-locating side is then capable of supporting axial thermal expansion of the roll of up to 15 mm. Due to this length compensation, almost no axial forces occur, which supports vibration-free running of the roll. Both bearing types are mounted directly on the tapered journals, ensuring high running accuracy. Axial location is carried out by means of a shaft nut HMZ.

Since very high heating temperatures sometimes occur during the heating phase, a radial internal clearance to Group 4 and case hardened inner rings (W209B) are normally used. With the characteristics described, the bearing combination shown is optimally suited to the requirements.



① Spherical roller bearing as locating bearing
② Toroidal roller bearing as non-locating bearing

Figure 2
Optimum bearing combination

Products used

- Toroidal roller bearing C31..-XL-K-W209B-C4 with bore code: 44, 48, 52, 56
- Spherical roller bearing 231..-BE-XL-K-W209B-C4 with bore code: 44, 48, 52, 56
- Shaft nut HM30 with bore code: 44, 48, 52, 56
- Shaft nut HMZ30 with bore code: 44, 48, 52, 56.

Application example
Steel industry

The operating conditions in continuous casting plant place very high requirements on the bearings used, *Figure 1*. The rolling bearings support high loads at low speeds; the bearings are exposed to high temperatures, spray water and contamination. Operating life values of 1 year to 2 years are required.

Figure 1
Continuous casting plant

Requirements

The requirements placed on the design are:

- high static load carrying capacity
- support of axial expansion of the shaft
- compensation of angular defects arising from shaft deflection.

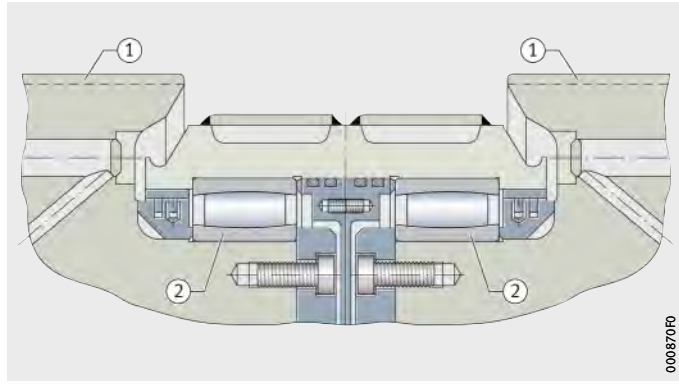
Schaeffler offers specially developed housings for this application. Further information on the housings is available on request.

Design solution

The strand guide rolls in the continuous casting plant are normally supported by means of a locating/non-locating bearing arrangement, *Figure 2*. The function of the non-locating bearings is to accommodate length expansion of the shaft as far as possible without constraint and to compensate for shaft deflection.

The toroidal roller bearing can effectively compensate changes in the length of the shaft due to the facility for displacement between the inner ring and outer ring. As a result of the internal geometry, angular defects arising from shaft deflection can be compensated.

Due to the full complement design in this application, the very high basic static load rating required can be achieved.



① Strand guide rolls
② Toroidal roller bearings

Figure 2
Bearing arrangement of strand guide rolls

Products used

- Toroidal roller bearing C40..-XL-V-C3 with bore code: 22, 24, 26, 28, 30, 32
- Toroidal roller bearing C40..-XL-V-C4 with bore code: 22, 24, 26, 28, 30, 32
- Toroidal roller bearing C41..-XL-V-C3 with bore code: 22, 24, 26, 28, 30, 32
- Toroidal roller bearing C41..-XL-V-C4 with bore code: 22, 24, 26, 28, 30, 32.

Application example
Ventilators

Ventilators are used in many branches of industry. In accordance with their function, they are described as fans or blowers, *Figure 1*. Depending on the direction of the air or gas flow, a distinction is made between radial and axial ventilators. They are used, for example, to improve the interior climate and aerate production buildings, tunnels and mines. In processes, they can accelerate combustion processes, start and maintain operation of process plant by means of gas mass flows or extract exhaust gases.

Figure 1
Ventilators

Requirements

The rolling bearings in such machines are subject to operating conditions such as high speeds, different loads, skewing and vibrations. The media conveyed, such as heating gas, require constraint-free adjustment of the non-locating bearing during operation.

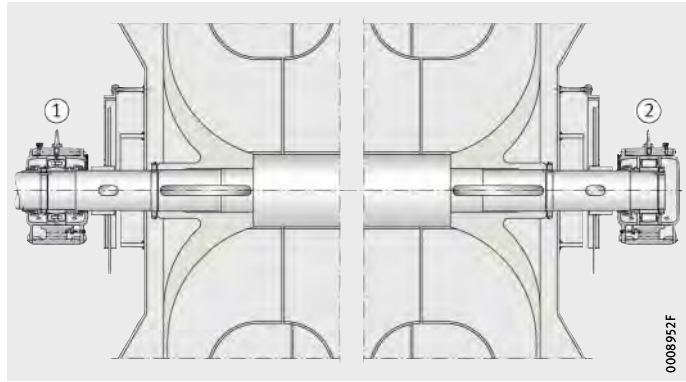
Schaeffler offers specially developed housings for this application. Further information on the housings is available on request.

Design solution

Through the use of the toroidal roller bearing as a non-locating bearing, the axial shaft offset resulting from the dynamically variable axial thrust can be compensated without constraint, *Figure 2*.

Furthermore, this gives the following advantages:

- constraint-free compensation within the bearing of the shaft length – no risk of the “stick-slip effect” in the housing bore
- reduction in vibrations and noise
- lower operating temperature relative to the complete system even under unfavourable operating conditions
- longer grease operating life
- reduced sensitivity to unbalance due to the feasibility of a tight outer ring fit.



① Spherical roller bearing
② Toroidal roller bearing

Figure 2
Blower bearing arrangement

Products used

- Toroidal roller bearing C22..XL-K-C3 with bore code: 12 to 24
- Toroidal roller bearing C23..XL-K-C3 with bore code: 12 to 24
- Spherical roller bearing 222..-E1-XL-K-C4
- Spherical roller bearing 223..-E1-XL-K-C4.

Application example
Marine propulsion systems

For marine propulsion systems, a conceptual distinction is made between compact designs and conventional power trains. This results in differing requirements. Across the concepts, the non-locating bearing function can be fulfilled by toroidal roller bearings, *Figure 1* and *Figure 2*.

Figure 1
Compact drives with a 360° rotation facility fitted to the stern of a ship

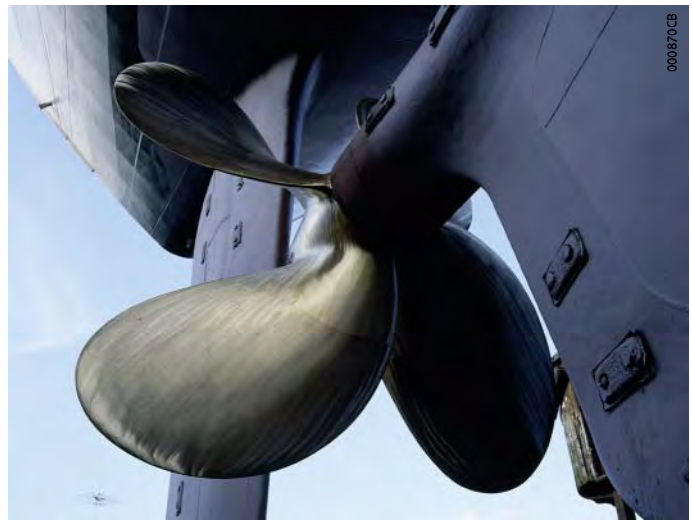


Figure 2
Rigid drive propeller at the end of a conventional drive train

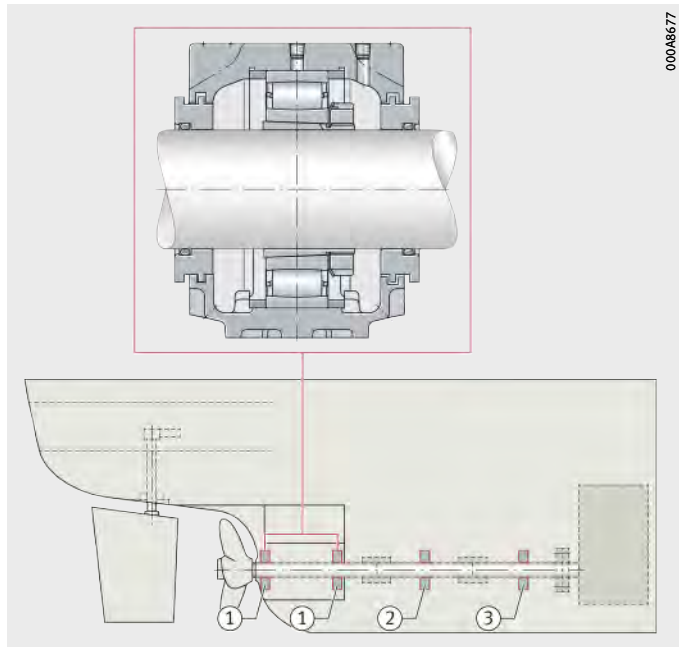
Requirements

In the case of conventional drives, it is normally misalignment resulting from shaft offset and deflection that must be supported. In compact drives, such as POD drives, the challenge is associated with temperature-induced elongations. When used in a non-locating bearing solution, the significant advantages of the axial displacement capability of a cylindrical roller bearing and the angular adjustability of a spherical roller bearing can be combined.

Schaeffler offers specially developed housings for this application. Further information on the housings is available on request.

Design solution

In conventional applications, the system solution results from the combination with spherical roller bearings for supporting axial loads. These are caused by the thrust of the propeller. Radial loads often occur as a result of structural shaft offsets, deflections in shaft segments in the drive train and the inherent mass, *Figure 3*.



① Toroidal roller bearing
② Radial spherical roller bearing
③ Axial spherical roller bearing

Figure 3
Cross-section of drive train

Application example
Marine propulsion systems

In nacelle drives, the toroidal roller bearing on the propeller side acts in combination with a thrust bearing unit, normally realised by means of two axial spherical roller bearings, *Figure 4*.

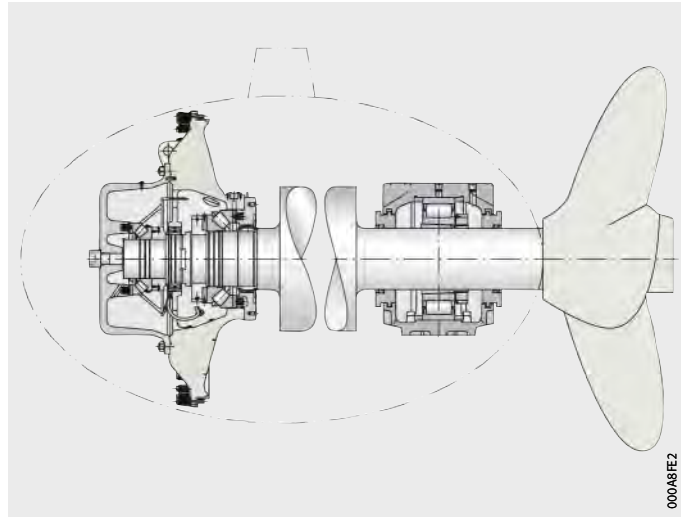


Figure 4
Cross-section of nacelle drive

Products used

- Toroidal roller bearing C30..-XL-K with bore code: 64, 84, 96 or alternatively 630 mm inner ring bore
- Radial spherical roller bearing 239..-B-K-MB with bore code: 76, 80, 88 or alternatively 630 mm inner ring bore
- Axial spherical roller bearing 294..-E1-XL with bore code: 84, 88 or alternatively 600 mm, or 630 mm inner ring bore.

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Schaeffler Technologies AG & Co. KG

Industriestraße 1–3
91074 Herzogenaurach
Germany
Internet www.schaeffler.de/en
E-mail info.de@schaeffler.com

In Germany:
Phone 0180 5003872
Fax 0180 5003873

From other countries:
Phone +49 9132 82-0
Fax +49 9132 82-4950

Schaeffler Technologies AG & Co. KG

Georg-Schäfer-Straße 30
97421 Schweinfurt
Germany
Internet www.schaeffler.de/en
E-mail faginfo@schaeffler.com

In Germany:
Phone 0180 5003872
Fax 0180 5003873

From other countries:
Phone +49 9721 91-0
Fax +49 9721 91-3435

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