CARB® toroidal roller bearings – a revolutionary concept

The SKF brand now stands for more than ever before, and means more to you as a valued customer.

While SKF maintains its leadership as the hallmark of quality bearings throughout the world, new dimensions in technical advances, product support and services have evolved SKF into a truly solutions-oriented supplier, creating greater value for customers.

These solutions encompass ways to bring greater productivity to customers, not only with breakthrough application-specific products, but also through leading-edge design simulation tools and consultancy services, plant asset efficiency maintenance programs, and the industry's most advanced supply management techniques.

The SKF brand still stands for the very best in rolling bearings, but it now stands for much more.

SKF – The knowledge engineering company

Contents

The winning combination

Self-alignment ...

Self-aligning bearings are the hallmark of SKF – not surprising since SKF was founded in 1907, based on the invention of the self-aligning ball bearing by Sven Wingquist. But the development did not stop there, other SKF inventions followed: the spherical roller bearing in 1919 and the spherical roller thrust bearing in 1939.

Self-alignment is called for

- when misalignment exists as a result of manufacturing or mounting errors
- when shaft deflections occur under load

and these have to be compensated for in the bearing arrangement without negative effects on performance or any reduction in bearing service life.

... and axial displacement ...

SKF was also heavily involved in the development of bearings having rings that can be axially displaced with respect to each other. In 1908, for example, the cylindrical roller bearing in its modern version was largely developed by Dr.-Ing. Josef Kirner of the Norma Compagnie in Stuttgart-Bad Cannstatt, which became a subsidiary of AB SKF.

Cylindrical roller bearings are applied when

- heavy radial loads and relatively high speeds prevail and
- thermal changes in shaft length must be accommodated in the bearing with as little friction as possible – provided, of course, that there is no significant misalignment.

... combined for success

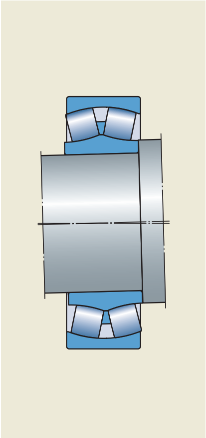
Previously, it was always necessary to compromise. Because misalignment or shaft bending makes the use of self-aligning bearings essential – and, depending on load and speed, the choice lay between self-aligning ball bearings and spherical roller bearings.

However, in contrast to cylindrical roller bearings, those bearings cannot accommodate important axial displacements within the bearing.

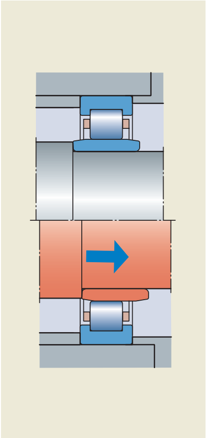
Therefore, it was necessary for one of the bearings to move axially on its seating in the housing. Such movement is always accompanied by considerable friction, which produces internal axial forces in the bearing arrangement. The result is a shortened bearing service life and relatively high costs for maintenance and repairs.

Today, this is a thing of the past. Because Magnus Kellström, a product designer at SKF, had a brilliant idea; he invented the toroidal roller bearing. This bearing not only can compensate for misalignment without friction, but also for changes in shaft length within the bearing. Thus a completely new type of bearing for non-locating arrangements has become available to the engineering world.

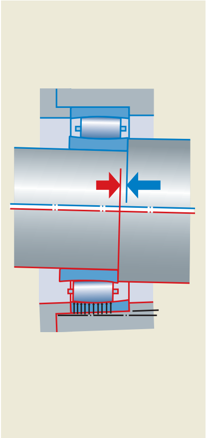
It is no longer necessary to compromise, and there are added benefits too – much longer service life for the complete bearing arrangement and minimized maintenance and repair costs.



Self-alignment ...



... and axial displacement ...



... combined in a toroidal roller bearing

SKF toroidal roller bearings with revolutionary design characteristics

The SKF toroidal roller bearing represents one of the most important breakthroughs in rolling bearing technology over the past sixty years. The bearing was introduced to the market the market in 1995 under the SKF trademark CARB®.

The CARB toroidal roller bearing is a completely new type of roller bearing, which offers benefits that were previously unthinkable. Irrespective of whether a new machine is to be designed or an older machine maintained there are benefits to be gained by using a toroidal roller bearing. Which of these benefits is realized depends on the machine design and its operating parameters.

The CARB bearing is a single row roller bearing with relatively long, slightly crowned rollers. The inner and outer ring raceways are correspondingly concave and symmetrical (➔ **fig 1**). The outer ring raceway geometry is based on a torus (➔ **fig 2**), hence the term toroidal roller bearing.

The SKF toroidal roller bearing is designed as a non-locating bearing that combines the self-aligning ability of a spherical roller bearing with the ability to accommodate axial displacement like a cylindrical or needle roller bearing. Additionally, if required, the toroidal roller bearing can be made as compact as a needle roller bearing.

An application incorporating an SKF toroidal roller bearing provides benefits outlined in the following.

Self-aligning capability

The self-aligning capability of the CARB bearing is particularly important in applications where there is misalignment as a result of manufacturing or mounting errors or shaft deflections. To compensate for these conditions, a CARB bearing can accommodate misalignment up to 0,5 degrees between the bearing rings without any detrimental effects on the bearing or bearing service life (➔ **fig 3**).

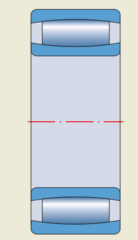
Axial displacement

Previously, only cylindrical and needle roller bearings could accommodate thermal expansion of the shaft within the bearing. Today, however, the CARB bearing can be added to that list (➔ **fig 4**). The inner and outer rings of a CARB bearing can be displaced, with respect to each other, up to 10 % of the bearing width. By installing the bearing so that one ring is initially displaced with respect to the other one, it is possible to extend the permissible axial displacement in one direction. In contrast to cylindrical and needle roller bearings that require accurate shaft alignment, this is not needed for toroidal roller bearings, which can also cope with shaft deflection under load. This provides a solution to many problem cases.

Long system life

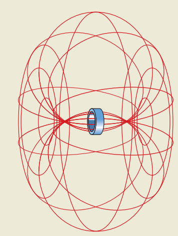
The ability to accommodate misalignment plus the ability to accommodate axial displacement with virtually no friction enables a CARB bearing to provide benefits to the bearing arrangement and its associated components (➔ **fig 5**).

Fig 1



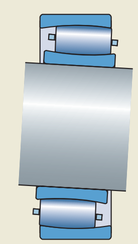
The CARB toroidal roller bearing

Fig 2



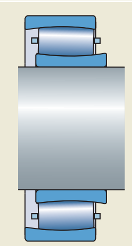
The torus

Fig 3



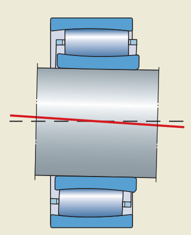
Angular misalignment
The most frequently occurring misalignments in operation are not a problem for a CARB toroidal roller bearing

Fig 4



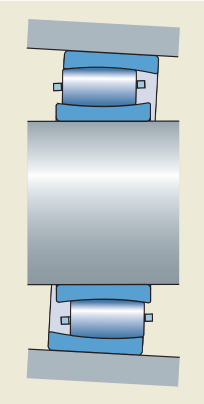
Axial displacement
Changes in shaft length are accommodated within the bearing virtually without friction

Fig 5



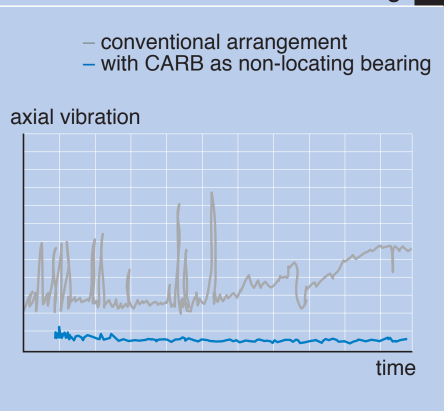
Freedom
Permissible angular misalignment + axial displacement within the bearing

Fig 6



Deviations from cylindrical form are less problematic
Demands on accuracy of form of the bearing seatings are less stringent, making simpler and less costly arrangements possible

Fig 7



Axial vibration
With a CARB bearing axial vibrations are considerably reduced, meaning longer service life and quieter operation

Full dimensional interchangeability
CARB advantages can be fully exploited when refurbishing non-locating bearing arrangements designed for self-aligning as well as rigid bearings

- Internal axial displacement is virtually without friction; there are no internally induced axial forces, thus operating conditions are considerably improved.
- The non-locating bearing as well as the locating bearing only need to support external loads.
- The bearings run cooler, the lubricant lasts longer and maintenance intervals can be appreciably extended.

Taken together, these benefits contribute to a longer system life.

High load carrying capacity
CARB toroidal roller bearings can accommodate very high radial loads. This is due to the optimized design of the rings combined with the design and number of rollers. The large number of long rollers make CARB bearings the strongest of all aligning roller bearings. Due to their robust design, CARB bearings can cope with small deformations and machining errors of the bearing seating (➔ **fig** 6). The rings accommodate these small imperfections without the danger of edge stresses. The high load carrying capacity plus the ability to compensate for small manufacturing or installation errors provide opportunities to increase machine productivity and uptime.

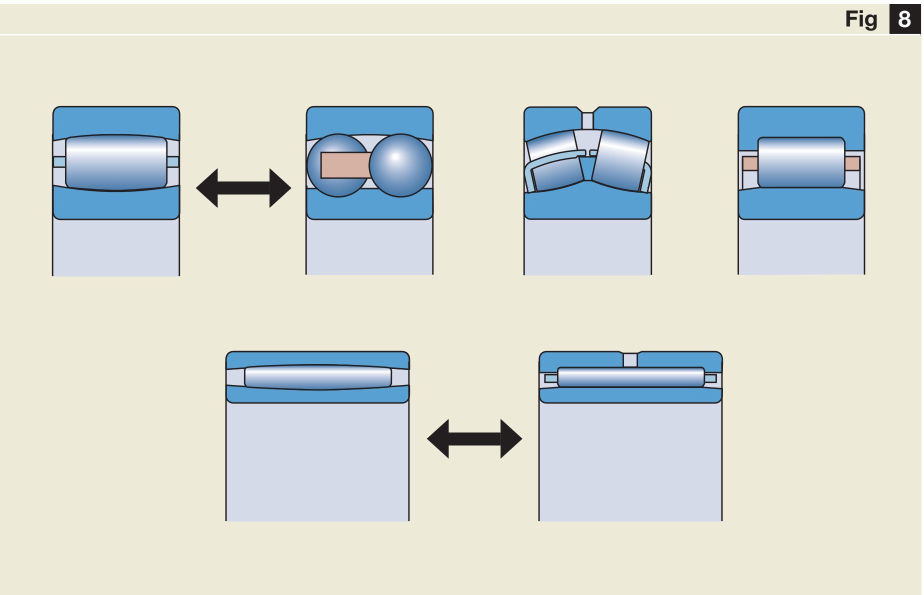
Increased performance or downsizing
For bearing arrangements incorporating a CARB toroidal roller bearing as non-locating bearing, internally induced axial forces are prevented. Together with high load carrying capacity this means that

- for the same bearing size in the arrangement, performance can be increased or the service life extended, or
- new machine designs can be made more compact to provide the same, or even higher performance.

Reduced vibration
Self-aligning ball or spherical roller bearings in the non-locating position need to be able to slide within the housing seating. This sliding, however, causes axial vibrations which can reduce bearing service life considerably.

Bearing arrangements that use CARB toroidal roller bearings as the non-locating bearing are stiff because the CARB bearing can be radially and axially located in the housing and on the shaft. This is possible because thermal expansion of the shaft is accommodated within the bearing. The stiffness of the bearing arrangement, combined with the ability of the CARB bearing to accommodate axial movement, substantially reduces vibrations within the application to increase service life of the bearing arrangement and related components (➔ **fig** 7).

Fig 8



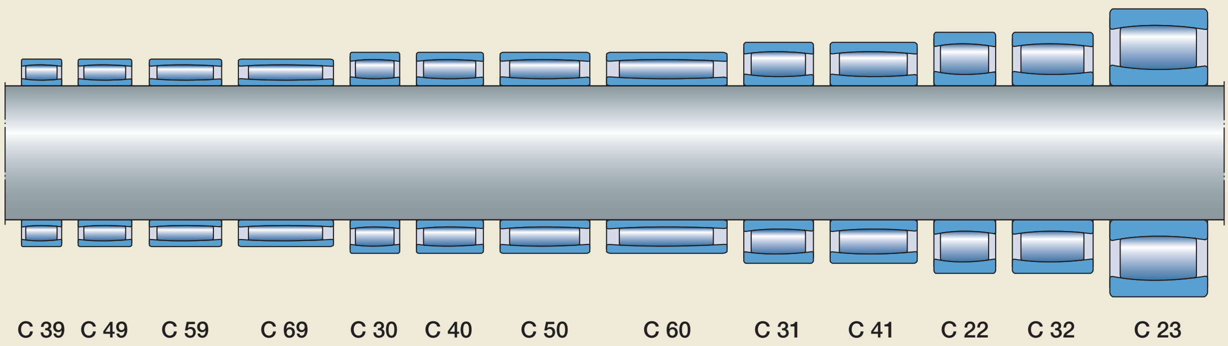
Full dimensional interchangeability
The boundary dimensions of SKF CARB toroidal roller bearings are in accordance with ISO 15:1998. This provides full dimensional interchangeability with self-aligning ball bearings, cylindrical roller and spherical roller bearings in the same Dimension Series. The CARB bearing range also covers wide bearings with low cross sections normally associated with needle roller bearings (➔ **fig** 8).

SKF Explorer class bearings

All CARB bearings are manufactured to the SKF Explorer performance class.

The range for all requirements

Fig 1



Overview of product range

The SKF standard range of CARB toroidal roller bearings comprises bearings in 13 ISO Dimension Series (➔ **fig** 1). The smallest bearing has a bore diameter of 25 mm and the largest one a bore diameter of 1 250 mm. Bearings with a bore diameter up to 1 800 mm can be produced. Whether a new bearing arrangement is to be designed or an existing arrangement upgraded most often there is an appropriate CARB toroidal roller bearing available or such a bearing could be manufactured.

SKF toroidal roller bearings are produced in

- a caged version (➔ **fig** 2) as well as
- a full complement version (➔ **fig** 3)

with

- a cylindrical bore, or
- a tapered bore.

The tapered bore has a taper of 1:12 or 1:30, depending on the Dimension Series.

In addition to the standard bearings, SKF also produces special executions to suit particular applications, e.g.

- bearings with case hardened inner rings to allow a heavy interference fit on the shaft/journal of dryer or Yankee cylinders, for example;
- bearings with a surface hardened cage for vibrating screens;
- sealed bearings, for example, for continuous casting plants (➔ **fig** 4). The permissible misalignment and axial displacement as well as the load carrying capacity are lower than for the corresponding bearing without seals.

Assortment

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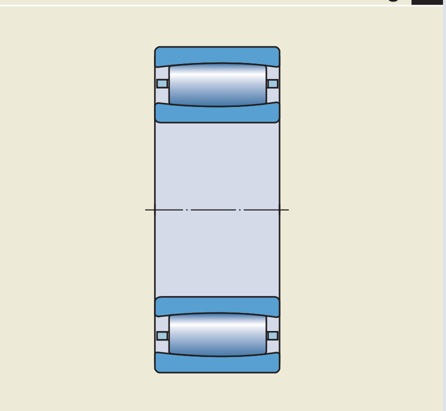
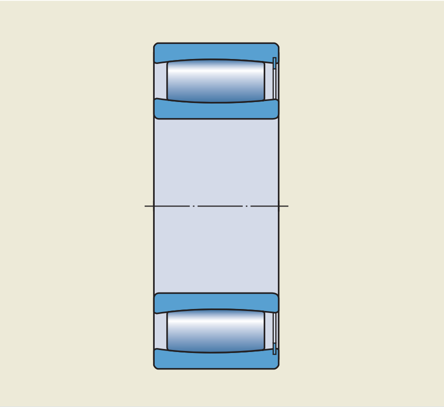
Fig 2



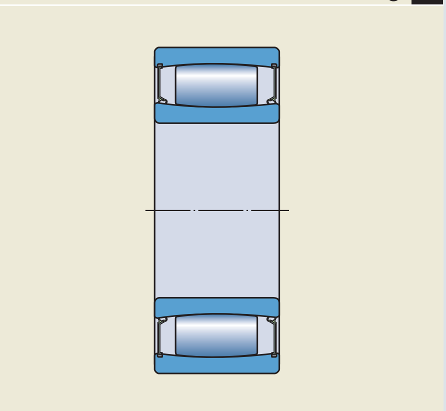
Caged bearing
For heavy loads and relatively high speeds

Fig 3



Full complement bearing
For very heavy loads and low speeds

Fig 4



Sealed bearing
Lubricated for life and protected against contamination

Availability

The product range is shown in the product tables starting on **page 44**. SKF recommends checking availability of those bearings marked with a triangle. To do that, contact your local SKF representative or SKF distributor. The standard range is being continuously extended and the intention is to manufacture all the products shown in the product tables in a few years time.

Bearing benefits

Already well proven in service, toroidal roller bearings enable all types of machines and equipment to be

- smaller,
- lighter,
- more cost-effective, and
- more operationally reliable.

Replacing other non-locating bearings with an equivalent CARB bearing can, depending on the application, improve perform-ance and uptime while de-creasing maintenance. Why not put CARB bearings to the test and reap the benefits they can provide?

The CARB toroidal roller bearing – the cornerstone of the new self-aligning bearing system

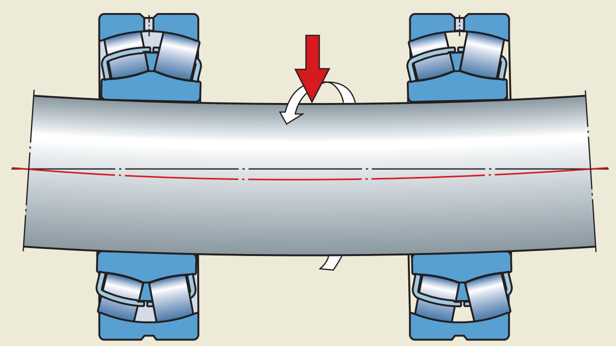
The conventional solution
Until recently a self-aligning bearing system consisted of two self-aligning ball bearings if there were high speeds and light loads, or two spherical roller bearings when there were heavy loads and moderate speeds. These bearing systems are simple, have good load carrying capacity and can compensate for misalignment resulting from manufacturing or mounting errors as well as shaft deflections (➔ **fig** 1). So far, so good – but what happens if the shaft were to expand axially?

In a traditional bearing arrangement, axial expansion of the shaft is accommodated by the non-locating bearing. The fits for this bearing are selected so that one of the bearing rings will be able to move axially on its seating as the shaft expands. Generally this movement is between the outer ring and the housing seating. This movement is always accompanied by friction, which gives rise to induced axial forces in both the bearings (➔ **fig** 2). In addition, the movement of the loose bearing on its seating can create damaging vibrations because the movement is "stick-slip" and not smooth (➔ **fig** 3).

The loose fit has a negative effect on the stiffness of the bearing arrangement. The bearing ring with the loose fit can also begin to "wander", which can wear the seating and lead to fretting corrosion and possibly "weld" the ring to its seating (➔ **fig** 4).

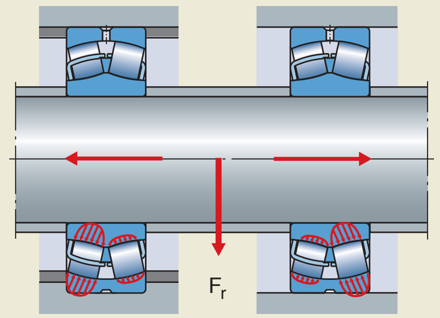
The new solution
Today, the CARB toroidal roller bearing is available for the non-locating position in a self-aligning bearing system. It is no longer necessary to compromise.

Fig 1



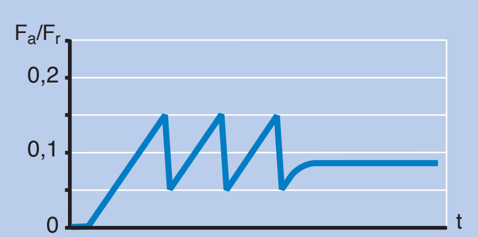
Conventional solution
Two spherical roller bearings (or self-aligning ball bearings) compensate easily for angular misalignment of the inner ring with respect to the outer ring

Fig 2



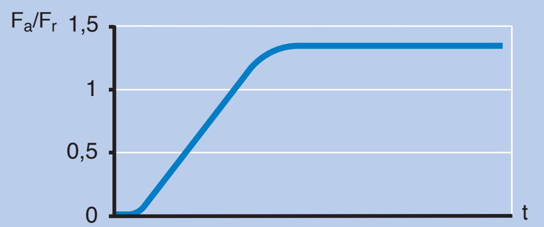
Axial expansion of the shaft can influence the load distribution in the bearings

Fig 3



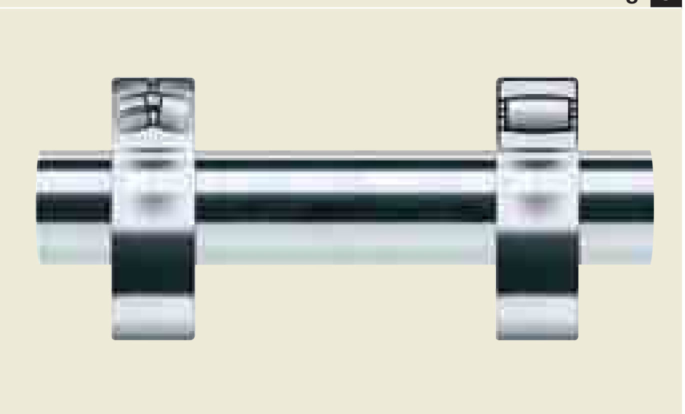
Load conditions in a conventional solution
Changes in axial force in a non-locating bearing during the machine start-up phase; internal axial forces of corresponding magnitude are produced in the locating bearing

Fig 4



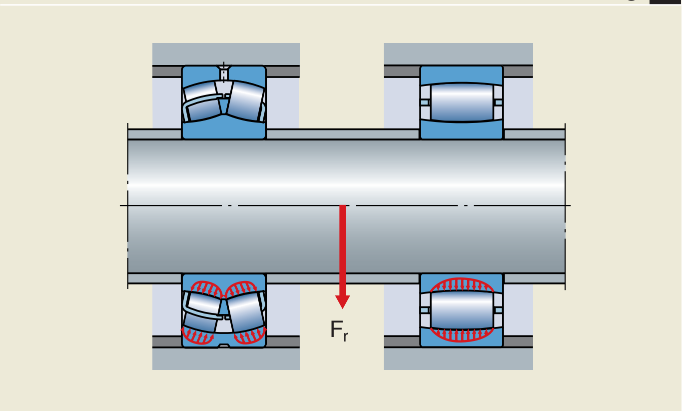
In a non-locating bearing which has been clamped in its housing bore seating, heavy axial forces prevail in the bearing arrangement after the start-up phase and dramatically shorten bearing service life

Fig 5



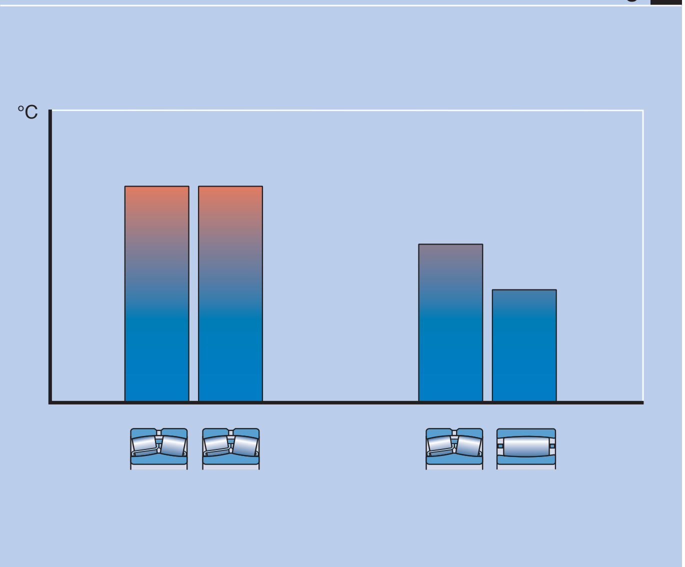
The new solution
A spherical roller bearing or a self-aligning ball bearing as the locating bearing and a CARB toroidal roller bearing as the non-locating bearing compensate for angular misalignment of the rings resulting from errors of alignment or deflection under load as well as thermal changes in shaft length, virtually without friction

Fig 6



There are no internally induced axial forces. The rings of the non-locating bearing should be axially and radially located

Fig 7



Lower operating temperatures extend relubrication intervals and bearing service life

CARB toroidal roller bearings are able to compensate for misalignment and accommodate axial displacements within the bearing (➔ **fig** 5). This means that both rings of the non-locating bearing can be axially located in the housing and on the shaft (➔ **fig** 6). If it is necessary to secure the rings so that they cannot “creep”, they can be mounted with an interference fit, thus enhancing the radial stiffness of the bearing arrangement.

This is an optimal solution for applications with undetermined load direction, e.g. vibrating applications, because internal preload and wear to the bearing seating in the housing are eliminated. No longer is there a compromise between a tight fit and axial freedom.

A CARB toroidal roller bearing is designed to accommodate axial displacement without inducing additional axial internal forces or friction (➔ **fig** 6). This means that the loads acting on the bearing are determined exclusively by external radial and axial forces. Because of this, a bearing system incorporating a CARB bearing will have lower loads and better load distribution than a conventional bearing system. This translates into lower operating temperatures, higher operating viscosities, extended relubrication intervals, and a significantly longer service life for both the bearings and the lubricant (➔ **fig** 7).

With a CARB toroidal roller bearing in the non-locating position, the many excellent design characteristics and properties of SKF spherical roller bearings and self-aligning ball bearings can be fully exploited. This provides new opportunities to further optimize machine design.

Successful in service

Although a recent invention, the CARB toroidal roller bearing can be found in a variety of applications spanning almost every industry. This bearing has already proven itself and in many cases has outperformed expectations by

- extending service life,
- increasing reliability,
- reducing maintenance, and
- providing more compact designs.

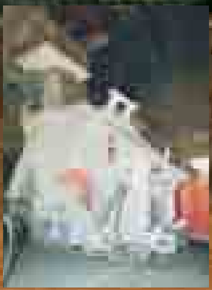
One of the major application areas for CARB toroidal roller bearings is in steelmaking and particularly in continuous casters where the multitude of guide rollers are subjected to the most difficult operating conditions. Paper machines are another important application where shaft deflections and thermal changes in roll length of up to 10 mm have to be accommodated.

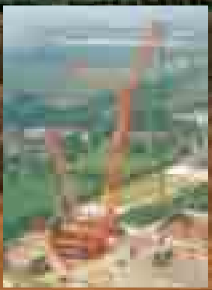
These are not the only fields where CARB toroidal roller bearings perform successfully. They are also in service in gearboxes, large electric motors, wind power plants, water turbines, bow thrusters, crane wheels, separators, centrifuges, presses, staking machines for tanneries, rotary cultivators and mulchers.

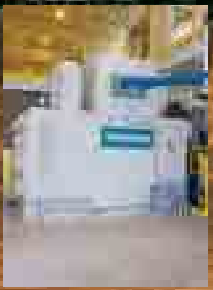
Main application areas
- Steelmaking and rolling mills
- Conveyors and roller beds
- Paper machines
- Fluid machinery
- Crushers
- Gearboxes of all types
- Textile machines
- Food and beverage processing machines
- Agricultural machinery
- Vibrating screens

Major demands
- Freedom
- High load carrying capacity
- High operational reliability
- Long service life
- Reduced maintenance
- Low operational costs
- Compact design
- Enhanced performance
- High power density

Solution







Application areas

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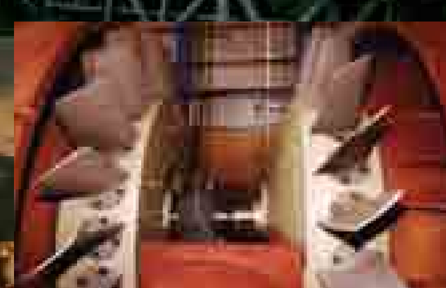
To facilitate the incorporation of CARB toroidal roller bearings in new as well as existing machines, please consult the SKF application engineering service.









Selection of bearing size

To calculate bearing size or the basic rating life for a toroidal roller bearing it is possible to use all the known and standardized (ISO 281) calculation methods. However, it is recommended that the SKF Life Method be applied so that the enhanced performance of SKF bearings can be fully exploited. Detailed information can be found in the SKF General Catalogue in the section "Selection of bearing size" or in the "SKF Interactive Engineering Catalogue" available on CD-ROM or online at www.skf.com.

For a self-aligning bearing system that uses an SKF Explorer spherical roller bearing and a CARB bearing, system life can be calculated using the SKF rating life equation:

$$L_{nm,Sys} = \sqrt[9/8]{\frac{1}{\frac{1}{L_{nm,SRB}^{9/8}} + \frac{1}{L_{nm,CARB}^{9/8}}}}$$

where

$L_{nm,Sys}$ = SKF rating life for the bearing system (at 100 – n % reliability), millions of revolutions

$L_{nm,SRB}$ = SKF rating life for the locating spherical roller bearing (at 100 – n % reliability), millions of revolutions

$L_{nm,CARB}$ = SKF rating life for the non-locating CARB toroidal roller bearing (at 100 – n % reliability), millions of revolutions

Longer life or downsizing

When used in a self-aligning bearing system, the CARB bearing prevents internally induced axial forces from occuring. This is in contrast to conventional self-aligning bearing systems with two spherical roller bearings or self-aligning ball bearings where the induced internal axial forces can be 20 % or more of the radial load acting on the non-locating bearing. These additional forces represent a sizeable proportion of the total load that cannot be neglected and can result in

- the bearing system not achieving the requisite life, or
- larger bearings being used to compensate for the additional forces.

Because a CARB toroidal roller bearing prevents internally induced axial forces from occuring, the load conditions in the bearing arrangement can be predicted accurately since the locating bearing is only subjected to its portion of the external radial and axial loads, while the non-locating bearing is only subjected to its portion of the radial load.

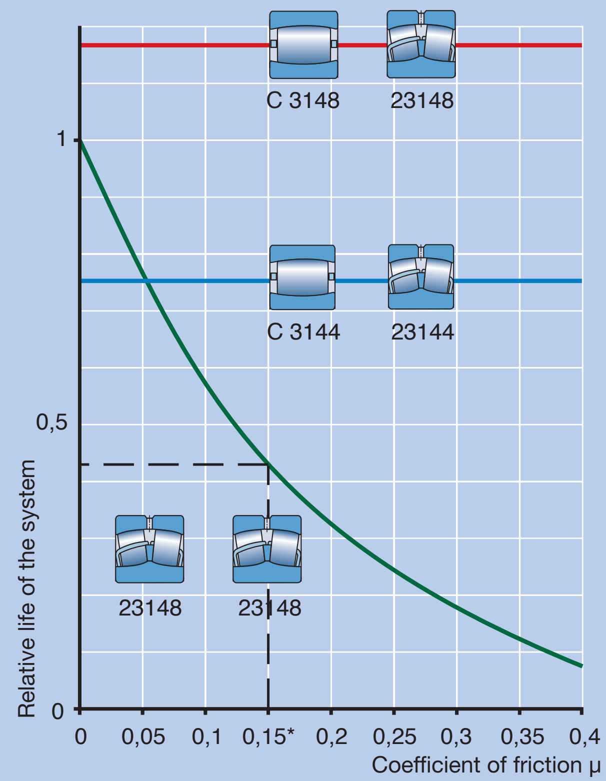
Whether a spherical roller bearing (➔ **diagram** 1) or a self-aligning ball bearing (➔ **diagram** 2) is used in the locating position, the new self-aligning bearing system can substantially increase the service life of a bearing arrangement. It is also worth noting that, even if smaller bearings are used, it is often possible to achieve system lives that are longer compared to the traditional systems. This can be exploited by downsizing adjacent components and reducing costs.

To take full advantage of the benefits offered by the new self-aligning system it is necessary to carefully select the bearing size – at the non-locating as well as the locating side. For assistance, contact the SKF application engineering service.

2

Compare the life of a conventional self-aligning bearing system with spherical roller bearings with a bearing system containing a CARB toroidal roller bearing and a spherical roller bearing

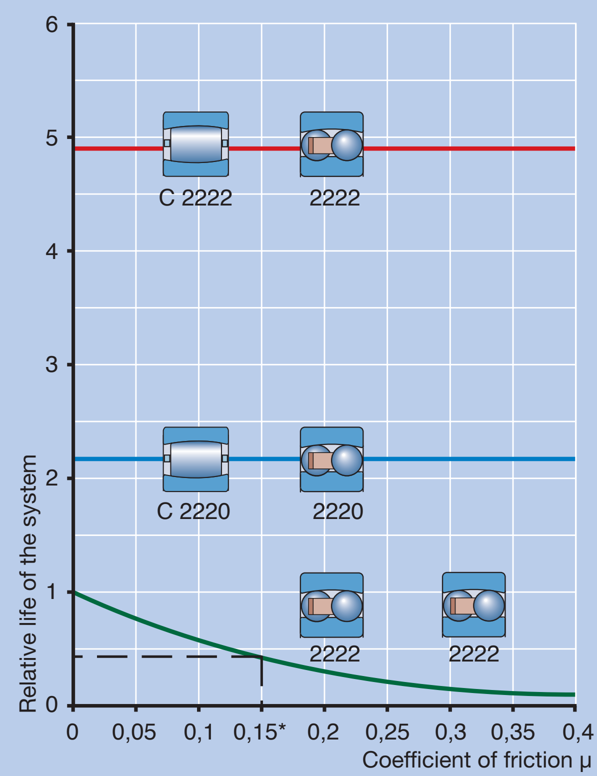
Diagram 1



* Typical value for steel on cast iron

Compare the life of a conventional self-aligning bearing system with self-aligning ball bearings with a bearing system containing a CARB toroidal roller bearing and a self-aligning ball bearing

Diagram 2



* Typical value for steel on cast iron

Design of bearing arrangements

Two bearings are generally required to support, guide and locate a shaft in the radial and axial directions. To do this, one bearing is designated the locating bearing and the other is the non-locating bearing.

In traditional self-aligning bearing systems, the locating bearing locates the shaft axially in its housing while the non-locating bearing typically moves in its housing to accommodate axial expansion of the shaft.

With the new SKF self-aligning bearing system, a CARB toroidal roller bearing is used in the non-locating position and either a spherical roller bearing (➔ **fig** 1) or a self-aligning ball bearing (➔ **fig** 2) is used in the locating position. Because a CARB bearing can accommodate axial expansion internally like a cylindrical roller bearing, it prevents internally induced axial forces from occuring that would otherwise that would otherwise be present if the bearing had to slide on its seating in the housing. This ability to accommodate internal axial forces allows the bearing rings to be axially located on the shaft and in the housing.

Radial location

To take advantage of the very high load carrying capacity and full life potential of a toroidal roller bearing, the bearing rings must be fully supported around their whole circumference and across the full width of the outer ring.

Selecting the proper fit

To locate a shaft radially, most applications require an interference fit between the bearing rings and their seatings. However, if easy mounting and dismounting are required, the outer ring will have a looser fit.

Recommendations for suitable shaft diameter and housing bore tolerances for CARB toroidal roller bearings are given in **tables** 1, 2 and 3. These recommendations apply to solid steel shafts and housings made from cast iron or steel.

Generally, CARB toroidal roller bearings follow the fit recommendations for spherical roller bearings on shafts and in housings. However, a spherical roller bearing on the non-locating side must be axially free, which requires a loose housing fit – this is not necessary for bearing arrangements using a CARB toroidal roller bearing. CARB bearings (and locating spherical roller bearings) can therefore utilise the advantages of tight outer ring fits if mounting and dismounting allow this, but for normal, stationary outer ring load it is not necessary. For example a K7 fit is applied to bearings in the split housing for a fan with an unbalanced fan rotor and a P7 fit applied to a non-split housing.

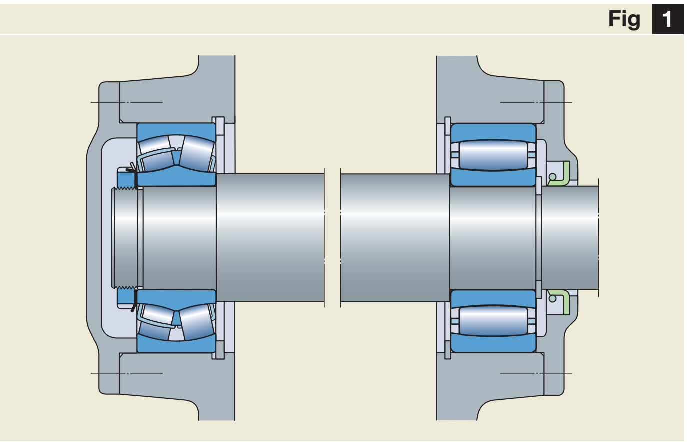
Bearings with a tapered bore are mounted either directly on a tapered journal or on an adapter or a withdrawal sleeve on cylindrical shaft seatings. The fit of the inner ring in these cases depends on how far the ring is driven up the tapered seating.

Accuracy of associated components

The accuracy of the cylindrical seatings on the shaft and in the housing bore should correspond to that of the bearing. For CARB toroidal roller bearings the shaft seating should be tolerance grade 6 and the housing seating grade 7. For an adapter or withdrawal sleeve, wider diameter tolerances can be

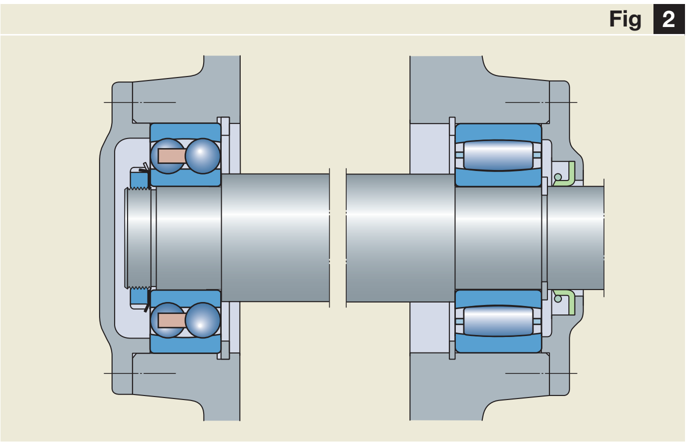
SKF self-aligning bearing system with a spherical roller bearing at the locating side and a CARB toroidal roller bearing at the non-locating side

Fig 1



SKF self-aligning bearing system with a self-aligning ball bearing at the locating side and a CARB toroidal roller bearing at the non-locating side

Fig 2



adopted for the cylindrical seating on the shaft, e.g. grade 9 or 10.

The cylindricity as defined in ISO 1101-1996 for the bearing seating should be 1 or 2 grades better than the recommended dimensional tolerance depending on the requirements. For example, a shaft seating machined to tolerance m6 should have a cylindricity grade 5 or 4.

Fits for solid steel shafts

Table 1

Conditions	Examples	Shaft diameter (mm) over	incl.	Tolerance
Bearings with cylindrical bore				
Rotating inner ring load or direction of load indeterminate				
Normal and heavy loads (P > 0,06 C)	General engineering, electric motors, pumps, gearboxes		40	k5
		40	65	m5
		65	100	m6
		100	140	n6
		140	280	p6
		280	500	r6[1)]
		500		r7[1)]
Very heavy loads and shock loads with difficult working conditions (P > 0,12 C)		50	100	n6[1)]
		100	140	p6[1)]
		140		r6[1)]
Bearings with tapered bore on adapter or withdrawal sleeves				
Normal loads and/or normal speeds				h10/IT7/2
Heavy loads and/or high speeds				h9/IT5/2
Stationary inner ring load				
Easy dismounting unnecessary				h6
Easy dismounting desirable				g6[2)]

1) Bearings with radial internal clearance greater than Normal may be necessary
2) Tolerance f6 can be selected for large bearings to provide easy displacement

Fits for non-split cast iron and steel housings

Table 2

Conditions	Examples	Tolerance	Remarks
Rotating outer ring load			
Heavy loads and shock loads	Crushers, vibrating screens, fans	N6	Bearing outside diameter < 160 mm
		P6	Bearing outside diameter ≥ 160 mm
Stationary outer ring load			
Loads of all kinds	General engineering	H7	
Direction of load indeterminate			
Heavy shock loads		M7	
Normal and heavy loads (P > 0,06 C)	General engineering, electric motors, pumps	K7	
		H7	Easy mounting of bearing required

Fits for split cast iron and steel housings

Table 3

Conditions	Examples	Tolerance
Stationary outer ring load		
Loads of all kinds	General engineering	H7
Direction of load indeterminate		
Loads of all kinds	General engineering, electric motors, pumps	J7

Axial location

The rings of CARB toroidal roller bearings should be axially located on both sides on the shaft as well as in the housing. SKF recommends arranging the bearing rings so that they abut a shoulder on the shaft or in the housing. Inner rings can be locked in position using

- a shaft (lock) nut (➔ **fig** 3),
- a retaining ring (➔ **fig** 4) or
- an end plate screwed to the shaft end (➔ **fig** 5).

Outer rings are usually secured in position in the housing by the end cover (➔ **fig** 6).

Instead of integral shaft and housing shoulders CARB toroidal roller bearings can be mounted against

- spacer sleeves (➔ **fig** 7) or
- retaining rings (➔ **fig** 8).

Bearings with a tapered bore that are mounted

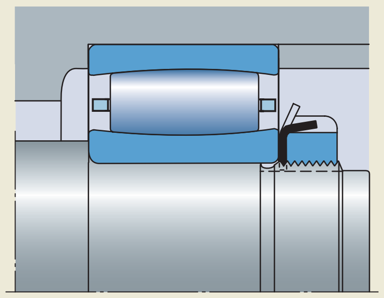
- directly onto a tapered journal are usually secured to the shaft with a nut on the threaded section (➔ **fig** 9), or
- on an adapter sleeve and a stepped shaft are secured against a spacer ring (➔ **fig** 10), or
- on a withdrawal sleeve against a shaft shoulder are secured by a shaft nut (➔ **fig** 11) or an end plate (➔ **fig** 12).

Abutment and fillet dimensions

The abutment and fillet dimensions, which include the diameters of shaft and housing shoulders, spacer sleeves etc. have been determined so that adequate abutment surfaces are provided for the side faces of the bearing rings without any danger of the rotating parts being fouled. The recommended abutment and fillet dimensions for each individual bearing can be found in the product tables.

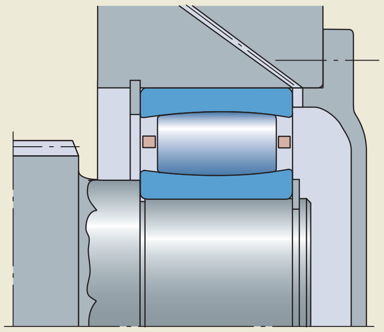
Inner ring located axially with a shaft nut

Fig 3



Inner ring located axially with a retaining ring

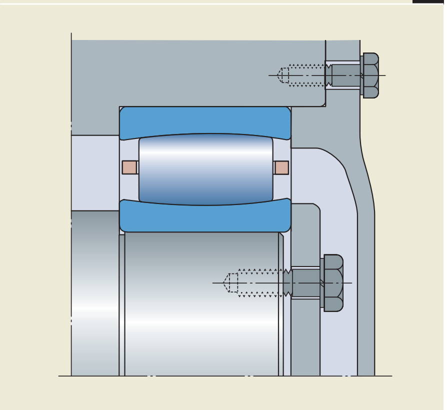
Fig 4



SKF

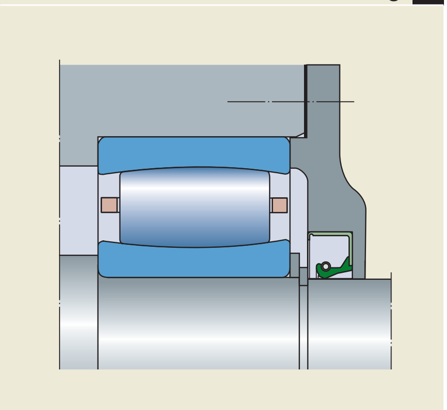
Axial location

Fig 5



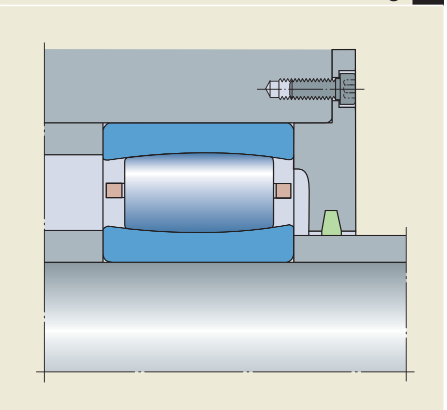
Inner ring located axially with an end plate

Fig 6



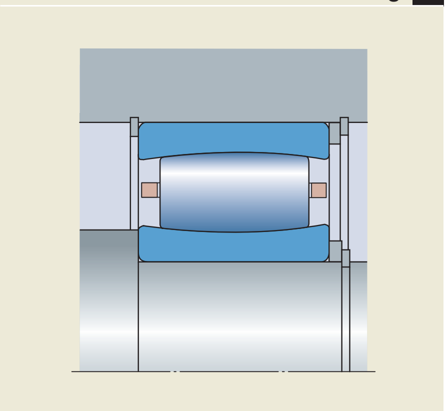
Outer ring located axially with an end cover

Fig 7



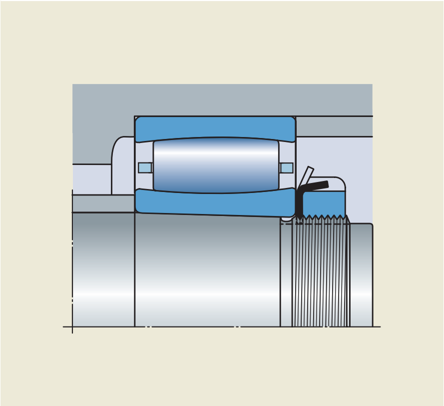
Spacer sleeves used to axially locate the inner and outer rings

Fig 8



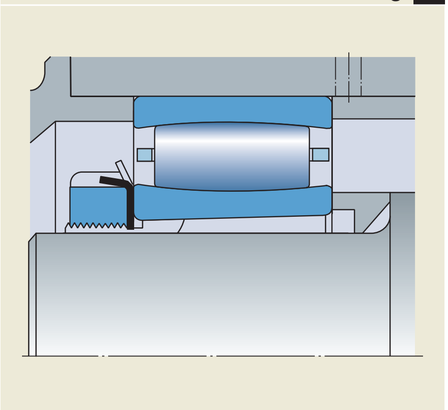
Retaining rings used to axially locate the bearing rings

Fig 9



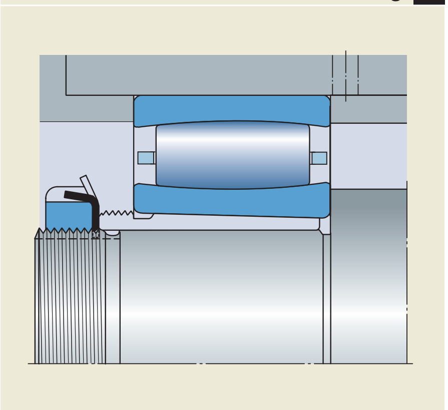
Inner ring on a tapered shaft held in place by a shaft nut

Fig 10



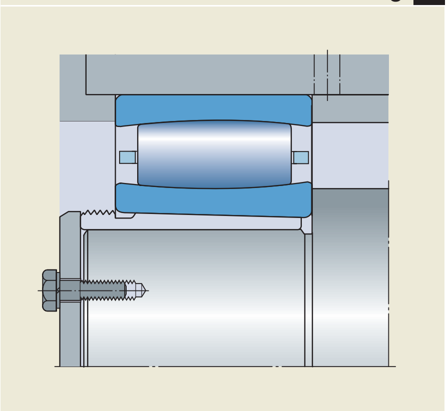
Inner ring on an adapter sleeve and a stepped shaft, axially located against a spacer ring

Fig 11



Inner ring on a withdrawal sleeve and a stepped shaft, axially located by a shaft nut

Fig 12



Inner ring on a withdrawal sleeve and a stepped shaft, axially located by an end plate

Design of adjacent components

Space on the sides of the bearing
To enable axial displacement of the shaft relative to the housing, space must be provided on both sides of the bearing as indicated in **fig 13**. The actual value for the width of this space can be estimated based on

- the value C_a (from the product tables),
- the axial displacement of the bearing rings from the central position expected in operation, and
- the displacement of the rings caused by misalignment

$$C_{areq} = C_a + 0{,}5\ (s + s_{mis})$$

or

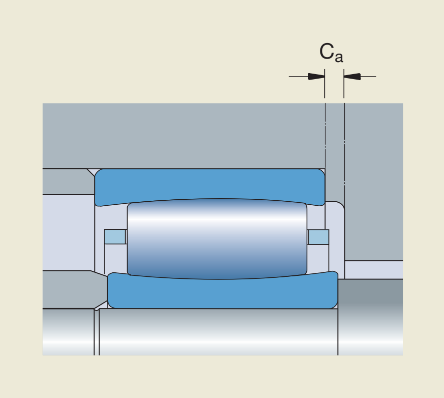
$$C_{areq} = C_a + 0{,}5\ (s + k_1\ B\ \alpha)$$

where
C_{areq} = width of space required on each side of the bearing, mm
C_a = minimum width of space required on each side of the bearing, mm (➔ product tables)
s = thermal change in shaft length, mm
s_{mis} = axial displacement of roller complement caused by misalignment, mm
k_1 = misalignment factor (➔ product tables)
B = bearing width, mm (➔ product tables)
α = angular misalignment, degrees

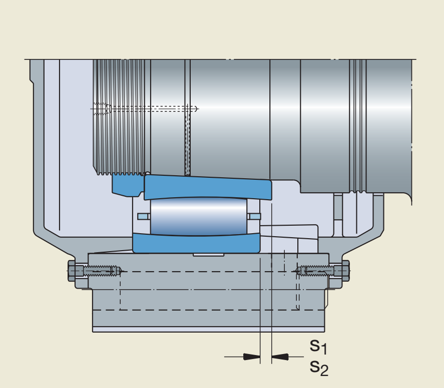
See also under “Axial displacement” on **page 40**.

Normally, the bearing rings are mounted so that they are not displaced with respect to each other. However, if considerable thermal changes in shaft length can be expected, the inner ring can be mounted offset relative to the outer ring up to the permissible axial displacement s_1 or s_2 in the direction opposite to the expected thermal elongation (➔ **fig 14**). In this way, the permissible axial displacement can be appreciably extended, an advantage which is made use of in the bearing arrangement of drying cylinders in papermaking machines.

It is particularly important when designing large bearing arrangements to take steps so that the mounting and dismounting of the bearings are facilitated or actually made possible.

Fig 13


Free space on both sides of the bearing

Fig 14


By mounting the outer ring purposely displaced with regard to the inner ring the permissible axial displacement can be extended

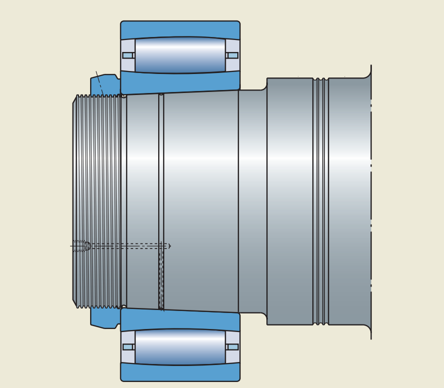
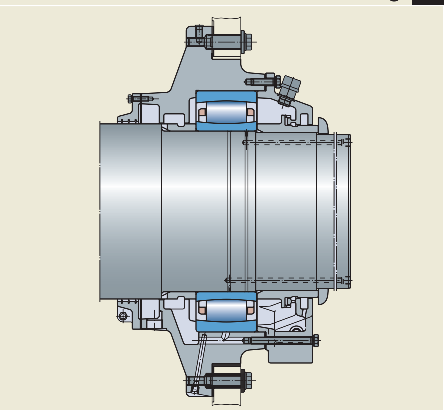
Fig 15

CARB toroidal roller bearing on a tapered journal with oil duct and distributor groove

Fig 16

CARB toroidal roller bearing arrangement with oil ducts and distributor grooves in the shaft and housing

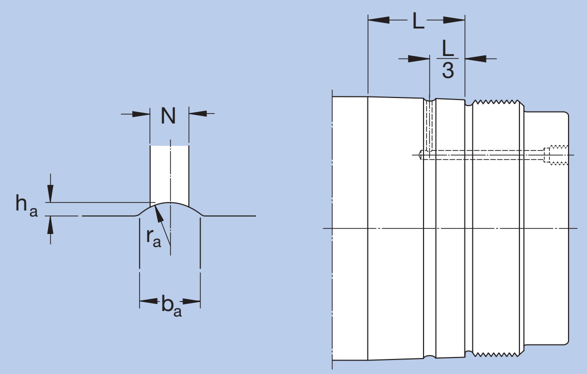
Threaded holes for the oil injection method
If the oil injection method is to be used

- for mounting and dismounting bearings on tapered journals (→ **fig 15**) or
- for dismounting bearings on or in cylindrical seatings on the shaft or in the housing

it is necessary to provide oil ducts and distributor grooves in the seating on the shaft or in the housing (→ **fig 16**). The distance of the distributor groove from the side at which the bearing is to be mounted and/or dismounted should correspond to approximately a third of the bearing width. Recommended dimensions for the distributor grooves, the oil ducts and the appropriate threads for the connections are given in **tables 4** and **5**.

Recommended dimensions for oil ducts and distributor grooves

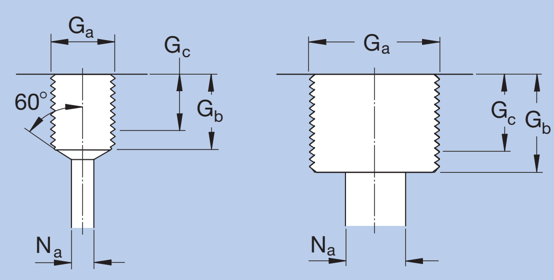
Table 4



Bearing seating diameter over	incl.	Dimensions b_a	h_a	r_a	N
mm		mm			
	100	3	0,5	2,5	2,5
100	150	4	0,8	3	3
150	200	4	0,8	3	3
200	250	5	1	4	4
250	300	5	1	4	4
300	400	6	1,25	4,5	5
400	500	7	1,5	5	5
500	650	8	1,5	6	6
650	800	10	2	7	7
800	1 000	12	2,5	8	8

Threaded connection holes

Table 5



Thread G_a	Design	Dimensions G_b	G_c[1)]	N_a max
–	–	mm		
M 6	A	10	8	3
G 1/8	A	12	10	3
G 1/4	A	15	12	5
G 3/8	B	15	12	8
G 1/2	B	18	14	8
G 3/4	B	20	16	8

1) Effective threaded length

Sealing the bearing arrangement

When selecting the most suitable sealing arrangement for a self-aligning bearing arrangement it is necessary to pay particular attention to

- the angular misalignment of the shaft and
- the magnitude of the axial displacement.

Otherwise the general selection criteria presented in the SKF General Catalogue (and the “SKF Interactive Engineering Catalogue”) apply and all types of seals can be used.

Non-contact seals are to be preferred when the operating conditions involve

- high speeds,
- large axial displacements,
- high temperatures,

and the sealing position is not directly exposed to contamination. The shaft should be horizontal.

The simple gap-type seal (➔ **fig** 17) is very suitable for sealing the non-locating arrangement of self-aligning bearing systems. The size of the gap can be adapted to the misalignment of the shaft and is not limited in any way.

Single or multi-stage labyrinth seals are obviously more efficient than the simple gap-type seal, but are more expensive. With CARB toroidal roller bearings, the labyrinth passages should be arranged axially in order to provide freedom of axial movement for the shaft in operation. If considerable misalignment is expected in operation, the passages should be angled (➔ **fig** 18). When split housings are used, labyrinth seals with radially arranged passages can be used, provided axial movement of the shaft relative to the housing is not limited (➔ **fig** 19).

Radial shaft seals are contact seals that are suitable for sealing greased or oil lubricated CARB toroidal roller bearings, provided misalignment is slight and the seal lip counterface is sufficiently wide (➔ **fig** 20).

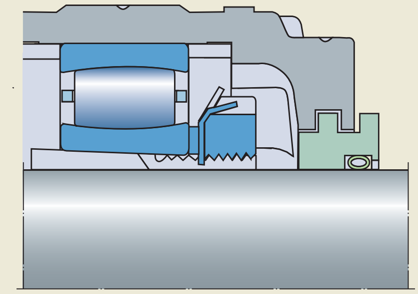
Some seal types are supplied as standard with SKF bearing housings and include a double-lip contact seal, a labyrinth seal as well as a Taconite seal (➔ **fig** 21). Additional information can be found in the brochure 4403 “SNL plummer block housings solve the housing problems”.

Reference
Additional information about radial shaft seals, V-ring seals or mechanical seals can be found in the SKF catalogue 4006 “CR seals” or in the “SKF Interactive Engineering Catalogue” on CD-ROM or online at www.skf.com.

Seals

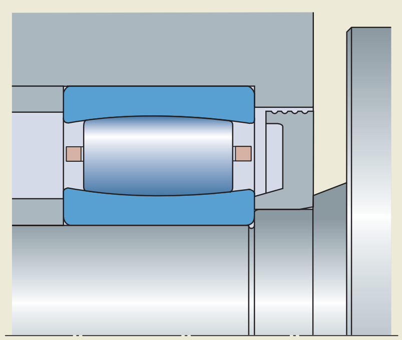
Labyrinth seal with radially arranged passages

Fig 19



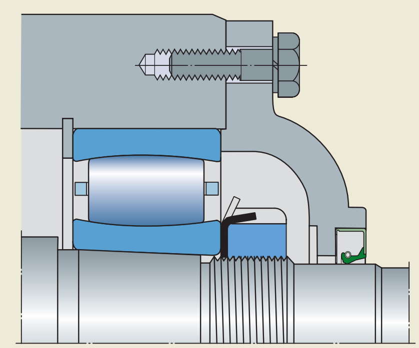
Gap-type seal

Fig 17



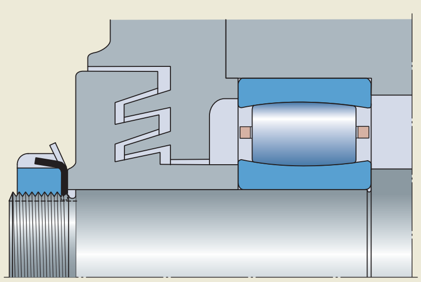
Radial shaft seal

Fig 20



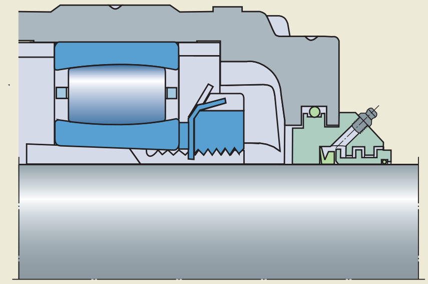
Labyrinth seal with angled passages

Fig 18



Taconite seal

Fig 21



Lubrication

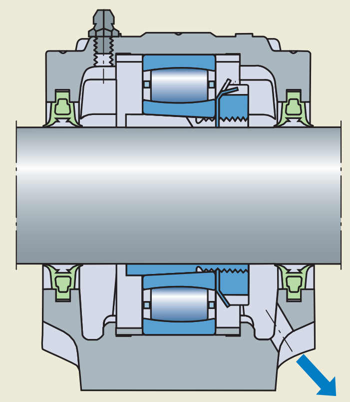
CARB toroidal roller bearings can be lubricated with grease as well as oil. There is no strict rule for when grease or oil should be used.

Grease has the advantage over oil that it is more easily retained in the bearing than oil and grease is better if the shaft is at an angle or arranged vertically.

On the other hand, oil lubrication allows higher operating speeds and temperatures and can contribute to heat removal from the bearing position, which is particularly important where external heating is involved. Very small quantities of lubricant are required to lubricate the bearing surfaces.

Since CARB toroidal roller bearings cannot be relubricated via the outer ring, lubricant has to be supplied from the side of the bearing. This is best done via a duct that opens immediately adjacent to the side face of the bearing outer ring. To force the lubricant to pass through the bearing, a drainage opening should be provided on the opposite side of the bearing (➔ **fig** 1).

Fig 1



Lubricant supply to the bearing

Grease lubrication

For the lubrication of CARB toroidal roller bearings good quality rust inhibiting greases that are resistant to ageing and have a consistency of 2 or 3 are suitable. Many factors influence the choice of grease. To assist in this process, SKF greases that are suitable for CARB bearing lubrication are listed in **table** 1.

The correct quantity of grease
For the majority of applications the following guidelines apply:

- Caged CARB toroidal roller bearings should be filled with grease to approximately 50 %. In bearings that are to be greased before mounting it is recommended just to fill the space between the inner ring and the cage (➔ **fig** 2).
- The free space in the bearing housing should be filled with grease to between 30 and 50 %.
- Full complement CARB toroidal roller bearings should be completely filled with grease.

For bearing arrangements that turn slowly but where good protection against corrosion is required, all the free space in the housing can be filled with grease as there is little risk of the operating temperature increasing.

Table 1

Operating conditions	**SKF grease** Designation	Temperature range	Viscosity at 40/100 °C
–	–	°C	mm^2/s
Standard bearing arrangements	LGMT 2	–30/+120	110/11
Standard bearing arrangements but with relatively high ambient temperatures	LGMT 3	–30/+120	125/12
Operating temperatures always over 100 °C	LGHB 2	–20/+150	420/26,5
High operating temperatures, smooth operation	LGHP 2	–40/+150	96/10,5
Shock loads, heavy loads, vibration	LGEP 2	–20/+110	200/16
High demands on environmental friendliness	LGGB 2	–40/+120	110/13

Full details on the mentioned SKF greases as well as the complete range of SKF greases will be found in
– SKF catalogue MP3000 “SKF Maintenance and Lubrication Products” or online at www.mapro.skf.com
– “SKF Interactive Engineering Catalogue” on CD-ROM or online at www.skf.com

Recommended SKF greases

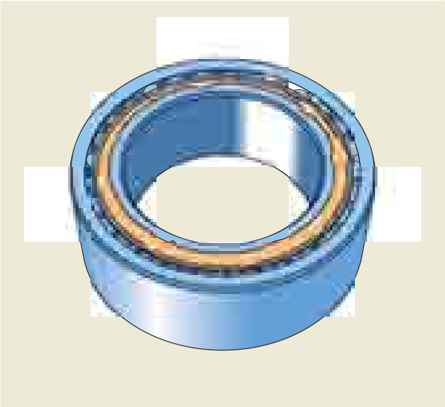
Table 2

Bearing design	Bearing factor	Maximum n × d_m C/P ≥ 15	C/P ≈ 8	C/P ≈ 4
CARB bearings with cage	2	350 000	200 000	100 000
CARB bearings – full complement[1)]	4	N.A[3)]	N.A[3)]	20 000[2)]

[1)] The t_f value obtained from diagram 1 needs to be divided by a factor 10
[2)] For higher speeds oil lubrication is recommended
[3)] For these C/P values a caged bearing is recommended instead

Bearing factors and recommended maximum speed limits

Fig 2



Bearing grease fill
Caged CARB toroidal roller bearings should not be completely filled with grease; for high speed operation fill only the space between the inner ring and the cage

Relubrication
CARB toroidal roller bearings have to be relubricated if the service life of the grease is shorter than the expected service life of the bearing. Relubrication should always be undertaken at a time when the existing lubricant is still satisfactory.

The time at which relubrication should be undertaken depends on many related factors. These include bearing type and size, speed, operating temperature, grease type, space around the bearing and the bearing environment.

It is only possible to base recommendations on statistical rules; the SKF relubrication intervals are defined as the time period, at the end of which 99 % of the bearings are still reliably lubricated. This represents L_1 for grease life.

SKF recommends using experience data from running applications and tests, together with the estimated relubrication intervals provided in the next section.

Relubrication intervals (t_f)
The relubrication intervals t_f for normal operating conditions are provided in **diagram 1**. The diagram is valid for bearings on horizontal shafts under clean conditions.

The value on the horizontal axis is obtained from “n × d_m” (rotational speed × bearing mean diameter) (unit: mm/min) multiplied by the relevant CARB toroidal roller bearing factor, which depends on the applied CARB toroidal roller bearing execution and loading situation. The bearing factor and recommended maximum “n × d_m” values for CARB toroidal roller bearings are given in **table 2**.

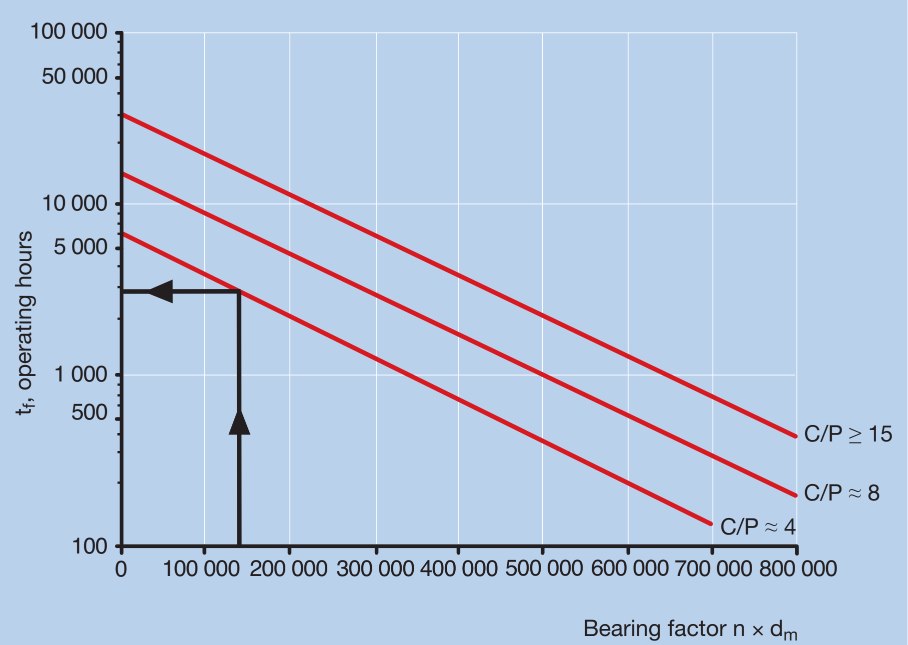
The t_f value is then derived considering the load magnitude, given by the value of C/P. The relubrication interval (t_f) is an estimated value, valid for an operating temperature of 70 °C, using good quality lithium base greases.

Different conditions are covered in detail in “Deviating conditions”.

If the value of “n × d_m” approaches the limit value (> 70 %) or if ambient temperatures are high, then the use of the calculations presented in the SKF General Catalogue, section “Speeds and vibration”, is recommended to check the operating temperature and the proper lubrication method.

Relubrication intervals for CARB toroidal roller bearings at 70 °C

Diagram 1



Example: CARB toroidal roller bearing C 2220 K
The bearing has a bore diameter d = 100 mm, an outside diameter D = 180 mm and rotates at a speed n = 1 000 r/min. The load ratio C/P is 4 and the operating temperature lies between 60 and 70 °C. What is the relubrication interval?

The bearing factor n × d_m is obtained as follows: n × d_m = 1 000 × 0,5 (d + D) = 1 000 × 0,5 (100 + 180) = 140 000. Follow a vertical line from the x-axis from the point n × d_m = 140 000 until it intersects the line of the load ratio C/P = 4. The relubrication interval can then be read off on the y-axis by drawing a horizontal line from the point of intersection with 3 000 operating hours.

Deviating conditions

Operating temperature
To account for the accelerated ageing of grease in hot running applications, SKF recommends halving the intervals obtained from the diagram for every 15 °C increase in bearing temperature above 70 °C.

The relubrication interval t_f may be extended at temperatures below 70 °C. In many cases the interval may also be prolonged if the load is low (C/P = 30 to 50). Extending the relubrication interval t_f by more than a factor of two is not recommended.

For full complement bearings, t_f values obtained from the diagram should not be prolonged.

Moreover, it is not advisable to use relubrication intervals in excess of 30 000 hours.

For many applications, there are practical grease lubrication limits, when the bearing ring with the highest temperature reaches an operating temperature of 100 °C. Above this temperature special greases should be used. In addition,temperature stability of the bearing and premature seal failure should be taken into consideration.

For high temperature applications, contact the SKF application engineering service.

Vertical shafts
For bearings on vertical shafts, the intervals obtained from the diagram should be halved.

The use of a good seal or retaining shield is a prerequisite or grease will leak from the bearing arrangement.

Vibrations
Mild vibrations will not have a negative effect on grease life, but high vibration and shock levels, such as those in vibrating screen applications, will cause the grease to churn. In these cases the relubrication interval should be reduced. If the grease becomes too soft, a grease with a better mechanical stability (e.g. LGHB 2) and/or a stiffer grease (NLGI 3) should be used.

Outer ring rotation
In applications where there is outer ring rotation, the value of the bearing factor $n \times d_m$ is calculated by applying the value of the bearing outside diameter D instead of d_m. The use of a good sealing mechanism is a prerequisite in order to avoid grease loss.

Under conditions of high outer ring speeds (i.e. > 50 % of the speed rating in the bearing tables), greases with a reduced bleeding tendency should be selected (e.g. lithium complex and polyurea).

Contamination
In case of ingress of contamination, a more frequent relubrication interval will reduce the negative effects of foreign particles on the bleeding characteristics of grease while reducing the damaging effects caused by overrolling of particles. Fluid contaminants (water, process fluids) also call for a reduced interval. In case of severe contamination, continuous relubrication should be considered.

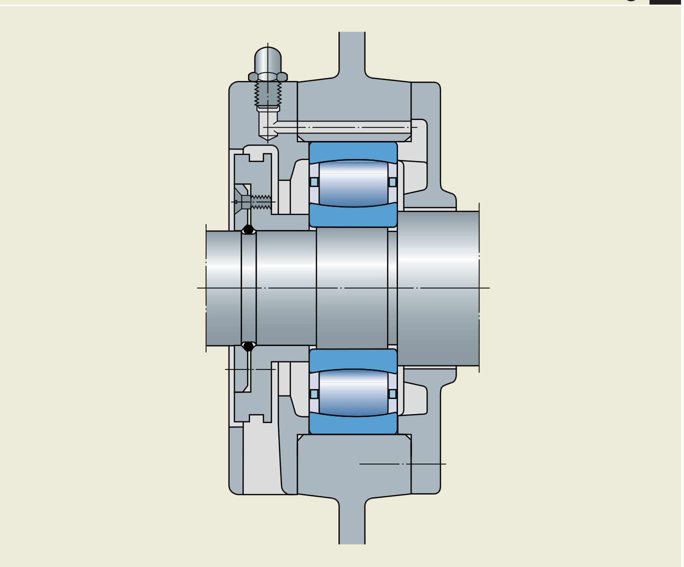
Requisite grease quantities for relubrication
The used grease in a CARB toroidal roller bearing should be replaced by fresh grease. The quantity of grease required for this depends on the bearing size; this can be determined using

$$G_p = 0{,}005\ D\ B$$

where
G_p = grease quantity required for periodic lubrication, g
D = bearing outside diameter, mm
B = bearing width, mm

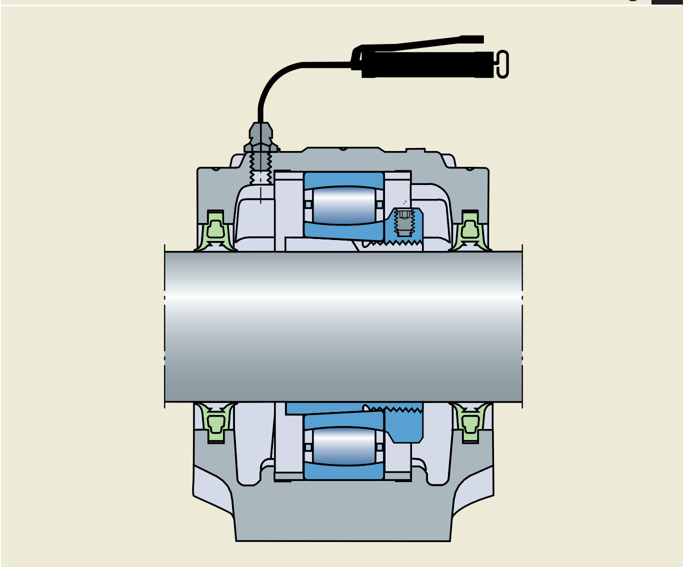
Grease valve
Excess grease is caused to enter a circular channel in the housing cover

Fig 3



Supplying grease to a CARB bearing
When using a hand-operated grease gun, excess pressure should be avoided or the seals may be damaged

Fig 4



Grease valve
If CARB toroidal roller bearings are to be relubricated frequently, there is a risk that too much grease will collect in the housing. This risk can be avoided by using a grease valve that allows excess grease to leave the housing (➔ **fig** 3).

The so-called grease valve consists of a washer that rotates with the shaft and forms a narrow gap to the housing cover. Excess grease is carried by the washer into this gap and leaves the housing by a grease escape hole in the base.

The grease should always be supplied from the side of the bearing opposite to the grease valve so that it is forced to pass through the bearing. When the bearing is mounted on an adapter sleeve, the lock nut with locking washer acts as a grease valve, so that grease should be supplied at the side opposite to the lock nut (➔ **fig** 4).

Oil lubrication

Oil lubrication is recommended or must be used if

- the relubrication intervals for grease are too short,
- speeds and/or operating temperatures are too high for grease,
- heat must be removed from the bearing position, or
- adjacent components are lubricated with oil.

For CARB toroidal roller bearings the following methods are normally employed:

- Oil bath lubrication where the oil is distributed by rotating machine components to the bearing arrangement and runs back to the sump.
- Circulating oil lubrication where the circulation is achieved by a pump and where the oil is filtered and cooled before being returned to the sump. The use of this method requires efficient sealing to prevent oil leakage.

The oil level should be checked regularly. The appropriate level should not be higher than the middle of the lowest roller when the bearing is stationary.

The lower limit should be 2 to 3 mm above the lowest point of the outer ring smallest diameter, D_1 in the product tables (➔ **fig** 5).

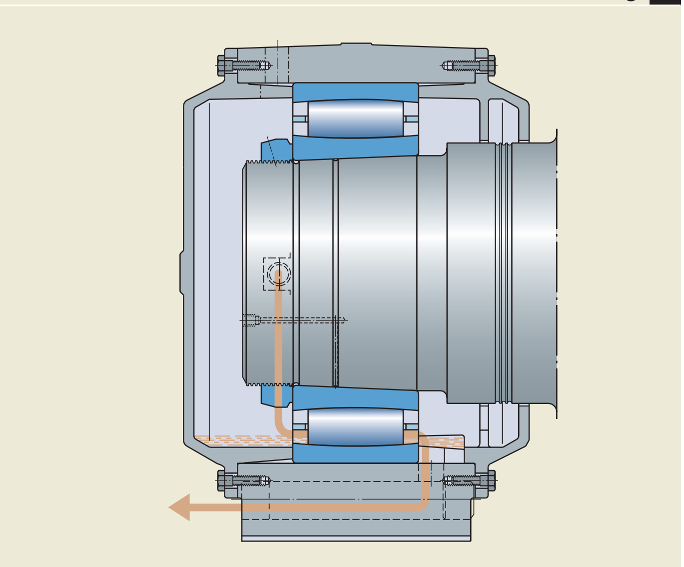
The same oils can be used for CARB toroidal roller bearings as for spherical and cylindrical roller bearings. They should

- have good thermal and chemical stability,
- contain anti-wear additives and
- provide good protection against corrosion.

Oils of viscosity class

- ISO VG 150 and ISO VG 220 can be used under normal conditions and
- ISO VG 320 and VG 460 may be more appropriate at high temperatures, under heavy loads and slow speeds.

Fig 5



Oil level in CARB toroidal roller bearing arrangements
Max.: middle of the lowest roller
Min.: 2 to 3 mm above the lowest point of the outer ring smallest diameter, D_1 in the product tables

Mounting

A variety of mechanical and hydraulic tools and heaters can be used to mount a CARB bearing. The procedures you choose will depend on the size of the bearing and the application. The one basic rule in any installation procedure is to avoid hitting the bearing rings, the rollers or cage.

Detailed information on mounting rolling bearings will be found in the publication 4100 “SKF Bearing Maintenance Handbook”, as well as online at www.skf.com/mount.

Mounting on cylindrical seatings

With CARB bearings, the ring that is to have the tighter fit should be mounted first. If the bearing is to be cold mounted on the shaft and in the housing at the same time a tool of the type shown in **fig** 1 should be used. This tool abuts both bearing rings to apply even pressure without damaging the rolling elements.

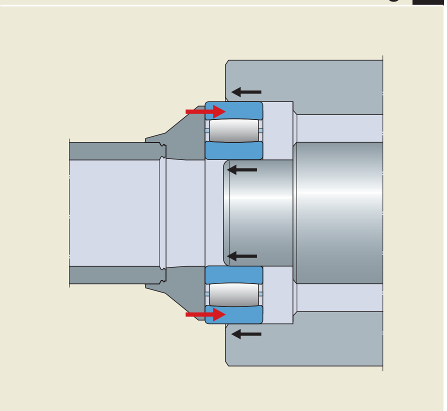
As a rule, larger bearings cannot be cold mounted, as the force required to press a bearing into position increases considerably with size. Therefore it is recommended

- to heat the bearing before it is mounted on the shaft, and
- to heat non-split housings before inserting the bearing.

To mount a bearing on the shaft, a temperature differential of 80 °C (between ambient temperature and heated inner ring) is usually sufficient. For housings, the appropriate differential depends on the degree of interference and the seating diameter. However, a moderate increase in temperature will usually suffice. An even and risk-free heating of CARB bearings can be achieved using an induction heater (➔ **fig** 2).

Mounting dolly with abutment faces for both bearing rings in the same plane

Fig 1



A CARB toroidal roller bearing on an induction heater

Fig 2

Mounting on tapered seatings

A CARB toroidal roller bearing with a tapered bore is always mounted on the shaft with an interference fit. To determine the degree of interference either the reduction in radial internal clearance or the amount by which the inner ring is driven up on its seating can be used.

Suitable methods for mounting a CARB bearing with a tapered bore are:

- measuring the clearance reduction,
- measuring the lock nut tightening angle,
- measuring the axial drive-up and
- measuring the inner ring expansion.

For CARB toroidal roller bearings with bore diameters greater than or equal to 50 mm, SKF recommends the SKF Drive-up method. This method is more accurate and takes less time than the procedure based on clearance reduction.

Measuring clearance reduction

Prior to mounting, the internal radial clearance must be measured with a feeler gauge between the outer ring and an unloaded roller. Before measuring, the bearing should be rotated a few times to make sure that the rollers have assumed their correct position. For the first measurement a blade should be selected that is slightly thinner than the minimum value for the clearance. During the measurement, the blade should be pushed backwards and forwards (➔ **fig 3**) until it can be inserted to the middle of the roller. The procedure should be repeated using slightly thicker blades each time until a certain resistance is felt.

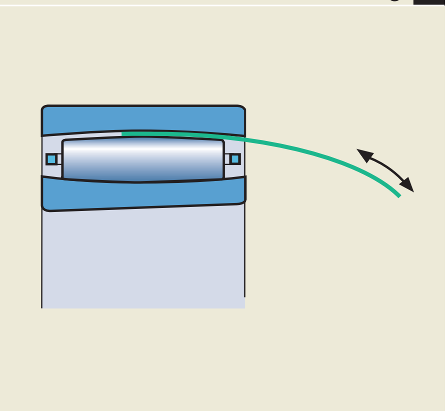
During mounting, the reduction in clearance should be measured between the outer ring raceway and the lowest roller (➔ **fig 4**). Again the bearing should be rotated a few times between each measurement.

Guideline values for the clearance reduction and axial drive-up are given in **table 2** on **page 28**. They are valid for solid steel shafts and normal operating conditions (C/P > 10). Where loads are heavy (C/P < 5), speeds high or there is a considerable temperature gradient across the bearing, greater clearance reductions or axial drive-up are required and thus bearings with greater initial radial internal clearance might be needed.

The minimum values given in **table 2** on **page 28** for the clearance reduction apply mainly to bearings having initial clearances close to the lower limits for clearance given in **table 2** on **page 39**. This will provide that the final clearance will not be less than the permissible minimum. For bearings with C3 or C4 clearance to have a sufficient degree of interference on their seating, it is recommended that the maximum clearance reductions be applied.

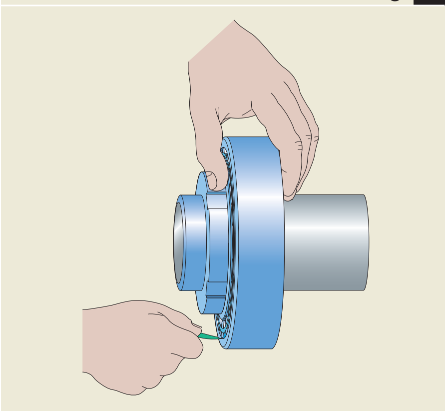
Move the blade backwards and forwards between roller and outer ring

Fig 3



Measuring clearance reduction

Fig 4

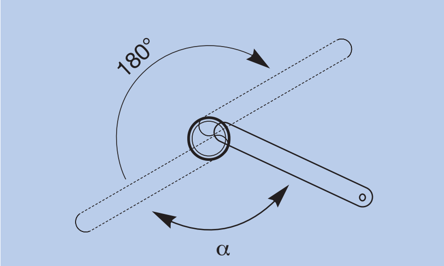


Measuring the lock nut tightening angle

Smaller bearings can easily be mounted using the tightening angle α through which the nut has to be turned to drive up the bearing properly on to its tapered seating. Where applicable, the tightening angle α is listed in **table 1**. Before mounting, the thread and side face of the nut should be coated with a molybdenum disulphide paste or similar lubricant and the seating should be lightly oiled with thin oil. The bearing is then pushed on to the tapered seating

Angular drive-up for CARB bearings

Table 1



Bearing designation	Clearance reduction	Axial drive-up	Turning angle α
–	mm	mm	degrees
C 2205	0,011	0,42	100
C 2206	0,013	0,45	105
C 2207	0,016	0,48	115
C 2208	0,018	0,52	125
C 2209	0,020	0,54	130
C 2210	0,023	0,58	140
C 2211	0,025	0,60	110
C 2212	0,027	0,65	115
C 2213	0,029	0,67	120
C 2214	0,032	0,69	125
C 2215	0,034	0,72	130
C 2216	0,036	0,77	140
C 2217	0,038	0,80	145
C 2218	0,041	0,84	150
C 2219	0,043	0,84	150
C 2220	0,045	0,87	155
C 2222	0,050	0,95	170
C 2314	0,032	0,72	130
C 2315	0,034	0,75	135
C 2316	0,036	0,78	140
C 2317	0,038	0,81	145
C 2318	0,041	0,86	155
C 2319	0,043	0,87	155
C 2320	0,045	0,90	160

and the nut screwed on. By turning the nut through the recommended angle α the bearing will be pressed up on the tapered seating. As the bearing has a tendency to skew when being pressed into place it is advisable to reposition the hook spanner in a slot at 180° to that used for tightening and then applying a light hammer blow to the hook spanner. The bearing will straighten up on its seating. Finally the residual clearance of the bearing should be checked.

In all cases, before mounting, the rust inhibiting oil should be wiped from the bore and outside diameter of new bearings and sleeves. The shaft seating and outside diameter of the sleeve should then be lightly oiled with thin oil.

The SKF Drive-up Method

The SKF Drive-up Method is based on measuring axial displacement of the bearing inner ring on its tapered seating from a reliably determined starting position.

The SKF Drive-up Method (➔ **fig** 5) requires the use of an HMV .. E hydraulic nut, that can accommodate a dial gauge. A pressure gauge, appropriate to the mounting conditions, mounted on a suitably sized hand pump, allows accurate pressure measurement to determine the starting position. The tools required are shown in **fig** 6.

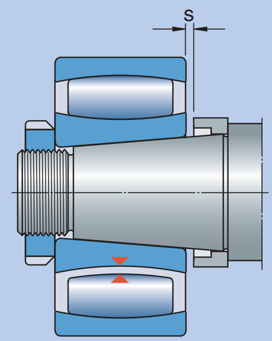
Guideline values for

- the requisite oil pressure and
- the axial displacement

for the individual bearings are provided in **table** 3 on **page 30**.

Guideline values for clearance reduction and axial drive-up

Table 2

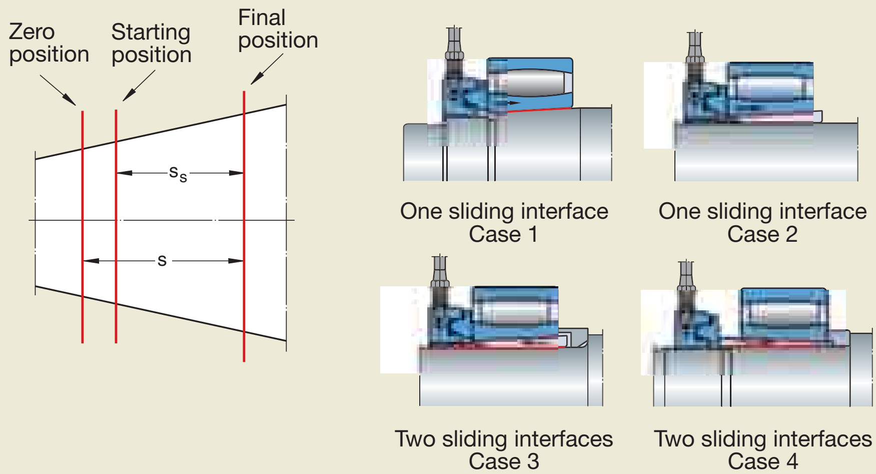


Bearing bore diameter d		Reduction of radial internal clearance		Axial drive-up s[1] Taper 1:12		Taper 1:30		Permissible residual radial clearance[2] after mounting bearings with initial clearance		
over	incl.	min	max	min	max	min	max	Normal	C3	C4
mm		mm		mm				mm		
24	**30**	0,012	0,018	0,25	0,34	0,64	0,85	0,025	0,033	0,047
30	**40**	0,015	0,024	0,30	0,42	0,74	1,06	0,031	0,038	0,056
40	**50**	0,020	0,030	0,37	0,51	0,92	1,27	0,033	0,043	0,063
50	**65**	0,025	0,039	0,44	0,64	1,09	1,59	0,038	0,049	0,074
65	**80**	0,033	0,048	0,54	0,76	1,36	1,91	0,041	0,055	0,088
80	**100**	0,040	0,060	0,65	0,93	1,62	2,33	0,056	0,072	0,112
100	**120**	0,050	0,072	0,79	1,10	1,98	2,75	0,065	0,083	0,129
120	**140**	0,060	0,084	0,93	1,27	2,33	3,18	0,075	0,106	0,147
140	**160**	0,070	0,096	1,07	1,44	2,68	3,60	0,085	0,126	0,173
160	**180**	0,080	0,108	1,21	1,61	3,04	4,02	0,093	0,140	0,193
180	**200**	0,090	0,120	1,36	1,78	3,39	4,45	0,103	0,150	0,209
200	**225**	0,100	0,135	1,50	1,99	3,74	4,98	0,113	0,163	0,228
225	**250**	0,113	0,150	1,67	2,20	4,18	5,51	0,123	0,175	0,251
250	**280**	0,125	0,168	1,85	2,46	4,62	6,14	0,133	0,186	0,276
280	**315**	0,140	0,189	2,06	2,75	5,15	6,88	0,143	0,198	0,292
315	**355**	0,158	0,213	2,31	3,09	5,77	7,73	0,161	0,226	0,329
355	**400**	0,178	0,240	2,59	3,47	6,48	8,68	0,173	0,251	0,358
400	**450**	0,200	0,270	2,91	3,90	7,27	9,74	0,183	0,275	0,383
450	**500**	0,225	0,300	3,26	4,32	8,15	10,80	0,210	0,295	0,433
500	**560**	0,250	0,336	3,61	4,83	9,04	12,07	0,225	0,327	0,467
560	**630**	0,280	0,378	4,04	5,42	10,09	13,55	0,250	0,364	0,508
630	**710**	0,315	0,426	4,53	6,10	11,33	15,25	0,275	0,386	0,560
710	**800**	0,355	0,480	5,10	6,86	12,74	17,15	0,319	0,430	0,620
800	**900**	0,400	0,540	5,73	7,71	14,33	19,27	0,335	0,465	0,675
900	**1 000**	0,450	0,600	6,44	8,56	16,09	21,39	0,364	0,490	0,740
1 000	**1 120**	0,500	0,672	7,14	9,57	17,86	23,93	0,395	0,543	0,823
1 120	**1 250**	0,560	0,750	7,99	10,67	19,98	26,68	0,414	0,595	0,885

[1] Only valid for solid steel shafts
[2] The residual clearance must be measured when the initial radial internal clearance (before mounting) lies in the lower half of the clearance range and if large temperature differences between inner and outer rings are to be expected in operation; the residual clearance should not be less than the minimum values quoted here. When measuring clearance care must be taken to see that both bearing rings and the roller complement are centrically arranged with respect to each other

The SKF Drive-up Method

Fig 5



1. Check whether the bearing size and the HMV .. E hydraulic nut coincide. Otherwise the values for the pressure given in **table 2** must be adjusted (➔ note on **page 32**).
2. Check the number of sliding interfaces (➔ above).
3. Lightly coat the sliding surfaces with a thin oil, e.g. SKF LHMF 300, and place the bearing on the tapered journal or sleeve. Screw the hydraulic nut on to the thread of the journal or sleeve so that it abuts the bearing and connect the appropriate oil pump (➔ **fig** 6).
4. Bring the bearing to its starting position. Pump oil into the hydraulic nut until the pressure quoted in **table** 3 on **page 30** is reached.
5. Set the dial gauge to “zero” (➔ **fig** 6) and pump more oil into the hydraulic nut until the bearing has been driven up the distance prescribed in **table** 3 on **page 30** and is in its final position.
6. After mounting has been completed, release the return valve of the oil pump, so that oil under high pressure in the nut can flow back out of the nut.
7. To completely empty the oil, bring the piston of the hydraulic nut to its original position. This is most simply done by screwing the nut further up the threaded portion of the journal or sleeve.
8. Remove the nut from the shaft by unscrewing and replace with a lock nut and a locking device.

Suitable tools for the SKF Drive-up Method

Fig 6

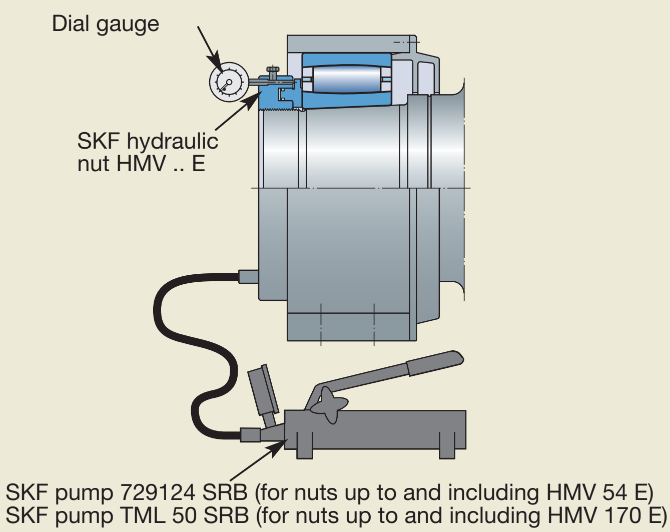


Table 3

Basic bearing designation	Starting position Requisite oil pressure for one sliding interface*	 two sliding interfaces*	Final position Axial displacement from starting position one sliding interface* s_s	 two sliding interfaces s_s	Radial clearance reduction from zero position Δ_r	Hydraulic nut Desig-nation	Piston area
–	MPa		mm		mm	–	mm^2
Series C 22							
C 2210 K	0,67	1,15	0,34	0,41	0,023	HMV 10 E	2 900
C 2211 K	0,57	0,98	0,35	0,42	0,025	HMV 11 E	3 150
C 2212 K	1,09	1,86	0,39	0,47	0,027	HMV 12 E	3 300
C 2213 K	0,82	1,40	0,40	0,47	0,029	HMV 13 E	3 600
C 2214 K	0,76	1,29	0,43	0,50	0,032	HMV 14 E	3 800
C 2215 K	0,70	1,20	0,45	0,52	0,034	HMV 15 E	4 000
C 2216 K	1,03	1,76	0,48	0,55	0,036	HMV 16 E	4 200
C 2217 K	1,12	1,91	0,50	0,57	0,038	HMV 17 E	4 400
C 2218 K	1,36	2,32	0,55	0,62	0,041	HMV 18 E	4 700
C 2219 K	1,02	1,74	0,54	0,62	0,043	HMV 19 E	4 900
C 2220 K	1,12	1,90	0,57	0,64	0,045	HMV 20 E	5 100
C 2222 K	1,49	2,54	0,63	0,71	0,050	HMV 22 E	5 600
C 2224 K	1,58	2,69	0,67	0,74	0,054	HMV 24 E	6 000
C 2226 K	1,44	2,46	0,71	0,79	0,059	HMV 26 E	6 400
C 2228 K	2,36	4,03	0,79	0,86	0,063	HMV 28 E	6 800
C 2230 K	1,79	3,05	0,82	0,89	0,068	HMV 30 E	7 500
C 2234 K	2,58	4,40	0,94	1,01	0,076	HMV 34 E	9 400
C 2238 K	1,77	3,01	1,01	1,08	0,086	HMV 38 E	11 500
C 2244 K	1,95	3,34	1,15	1,22	0,100	HMV 44 E	14 400
Series C 23							
C 2314 K	2,01	3,43	0,46	0,53	0,032	HMV 14 E	3 800
C 2315 K	2,25	3,84	0,48	0,55	0,034	HMV 15 E	4 000
C 2316 K	2,11	3,61	0,49	0,56	0,036	HMV 16 E	4 200
C 2317 K	2,40	4,10	0,52	0,59	0,038	HMV 17 E	4 400
C 2318 K	2,88	4,91	0,57	0,64	0,041	HMV 18 E	4 700
C 2319 K	2,22	3,79	0,57	0,64	0,043	HMV 19 E	4 900
C 2320 K	2,56	4,36	0,59	0,66	0,045	HMV 20 E	5 100
C 2326 K	2,71	4,62	0,73	0,81	0,059	HMV 26 E	6 400
Series C 30							
C 3022 K	0,97	1,66	0,62	0,69	0,050	HMV 22 E	5 600
C 3024 K	0,92	1,58	0,65	0,72	0,054	HMV 24 E	6 000
C 3026 K	1,23	2,10	0,72	0,79	0,056	HMV 26 E	6 400
C 3028 K	1,25	2,13	0,76	0,83	0,063	HMV 28 E	6 800
C 3030 K	1,02	1,73	0,80	0,87	0,068	HMV 30 E	7 500
C 3032 K	1,33	2,26	0,86	0,93	0,072	HMV 32 E	8 600
C 3034 K	1,52	2,60	0,90	0,98	0,076	HMV 34 E	9 400
C 3036 K	1,43	2,44	0,95	1,02	0,081	HMV 36 E	10 300
C 3038 K	1,60	2,73	1,02	1,09	0,086	HMV 38 E	11 500
C 3040 K	1,62	2,76	1,06	1,13	0,090	HMV 40 E	12 500
C 3044 K	1,58	2,69	1,15	1,22	0,099	HMV 44 E	14 400
C 3048 K	1,34	2,29	1,23	1,30	0,108	HMV 48 E	16 500
C 3052 K	1,77	3,02	1,35	1,43	0,117	HMV 52 E	18 800
C 3056 K	1,69	2,89	1,52	1,45	0,126	HMV 56 E	21 100
C 3060 K	1,85	3,16	1,55	1,62	0,135	HMV 60 E	23 600
C 3064 K	1,80	3,08	1,65	1,72	0,144	HMV 64 E	26 300
C 3068 K	2,04	3,48	1,76	1,83	0,153	HMV 68 E	28 400
C 3072 K	1,65	2,82	1,82	1,89	0,162	HMV 72 E	31 300

* The quoted values are for hydraulic nuts, the thread diameter of which corresponds to the bore diameter of the bearing to be mounted and for applications with lightly oiled sliding surfaces

Continuation table 3

Basic bearing designation	Starting position Requisite oil pressure for one sliding interface*	two sliding interfaces*	Final position Axial displacement from starting position one sliding interface* s_s	two sliding interfaces s_s	Radial clearance reduction from zero position Δ_r	Hydraulic nut Desig-nation	Piston area
–	MPa		mm		mm	–	mm^2
Series C 30							
C 3076 K	1,36	2,32	1,88	1,95	0,171	HMV 76 E	33 500
C 3080 K	1,54	2,63	1,99	2,06	0,180	HMV 80 E	36 700
C 3084 K	1,34	2,29	2,07	2,14	0,189	HMV 84 E	40 000
C 3088 K	1,22	2,08	2,14	2,21	0,198	HMV 88 E	42 500
C 3092 K	2,00	3,42	2,33	2,41	0,207	HMV 92 E	45 100
C 3096 K	1,75	2,99	2,40	2,47	0,216	HMV 96 E	48 600
C 30/500 K	1,56	2,66	2,47	2,54	0,225	HMV 100 E	51 500
C 30/530 K	1,54	2,63	2,60	2,68	0,239	HMV 106 E	56 200
C 30/560 K	2,26	3,85	2,84	2,91	0,252	HMV 112 E	61 200
C 30/600 K	1,92	3,28	2,98	3,06	0,270	HMV 120 E	67 300
C 30/630 K	1,68	2,87	3,09	3,16	0,284	HMV 126 E	72 900
C 30/670 K	2,12	3,61	3,34	3,41	0,302	HMV 134 E	79 500
C 30/710 K	1,73	2,96	3,47	3,54	0,320	HMV 142 E	87 700
C 30/750 K	1,89	3,22	3,68	3,75	0,338	HMV 150 E	95 200
C 30/800 K	1,88	3,22	3,91	3,98	0,360	HMV 160 E	103 900
C 30/850 K	1,90	3,24	4,15	4,22	0,383	HMV 170 E	114 600
C 30/900 K	1,60	2,73	4,32	4,39	0,405	HMV 180 E	124 100
C 30/950 K	1,94	3,30	4,62	4,69	0,428	HMV 190 E	135 700
C 30/1000 K	1,93	3,30	4,85	4,92	0,450	HMV 200 E	145 800
Series C 31							
C 3120 K	1,27	2,16	0,57	0,64	0,045	HMV 20 E	5 100
C 3130 K	2,41	4,12	0,84	0,91	0,068	HMV 30 E	7 500
C 3132 K	2,07	3,54	0,87	0,94	0,072	HMV 32 E	8 600
C 3134 K	1,84	3,13	0,90	0,97	0,076	HMV 34 E	9 400
C 3136 K	1,71	2,92	0,94	1,01	0,081	HMV 36 E	10 300
C 3138 K	2,27	3,87	1,02	1,10	0,086	HMV 38 E	11 500
C 3140 K	2,71	4,63	1,08	1,16	0,090	HMV 40 E	12 500
C 3144 K	2,76	4,71	1,18	1,26	0,099	HMV 44 E	14 400
C 3148 K	2,01	3,44	1,24	1,31	0,108	HMV 48 E	16 500
C 3152 K	2,76	4,70	1,37	1,44	0,117	HMV 52 E	18 800
C 3156 K	2,63	4,49	1,47	1,54	0,126	HMV 56 E	21 100
C 3160 K	2,81	4,79	1,57	1,64	0,135	HMV 60 E	23 600
C 3164 K	2,09	3,56	1,61	1,68	0,144	HMV 64 E	26 300
C 3168 K	2,84	4,85	1,75	1,82	0,153	HMV 68 E	28 400
C 3172 K	2,46	4,20	1,83	1,90	0,162	HMV 72 E	31 300
C 3176 K	2,57	4,39	1,93	2,01	0,171	HMV 76 E	33 500
C 3180 K	3,32	5,66	2,10	2,17	0,180	HMV 80 E	36 700
C 3188 K	2,38	4,06	2,20	2,27	0,198	HMV 88 E	42 500
C 3184 K	3,29	5,62	2,17	2,25	0,189	HMV 84 E	40 000
C 3192 K	3,57	6,09	2,39	2,46	0,207	HMV 92 E	45 100
C 3196 K	3,51	6,00	2,48	2,56	0,216	HMV 96 E	48 600
Series C 31							
C 31/500 K	3,54	6,04	2,57	2,64	0,225	HMV 100 E	51 500
C 31/530 K	3,40	5,81	2,71	2,79	0,239	HMV 106 E	56 200
C 31/560 K	3,11	5,30	2,83	2,90	0,252	HMV 112 E	61 200
C 31/600 K	3,15	5,38	3,01	3,09	0,270	HMV 120 E	67 300
C 31/630 K	3,36	5,74	3,18	3,26	0,284	HMV 126 E	72 900
C 31/670 K	3,48	5,95	3,38	3,45	0,302	HMV 134 E	79 500

* The quoted values are for hydraulic nuts, the thread diameter of which corresponds to the bore diameter of the bearing to be mounted and for applications with lightly oiled sliding surfaces

Continuation table 3

Basic bearing designation	Starting position Requisite oil pressure for one sliding interface*	two sliding interfaces*	Final position Axial displacement from starting position one sliding interface* s_s	two sliding interfaces s_s	Radial clearance reduction from zero position Δ_r	Hydraulic nut Desig-nation	Piston area
–	MPa		mm		mm	–	mm^2
Series C 31							
C 31/710 K	3,58	6,10	3,59	3,67	0,320	HMV 142 E	87 700
C 31/750 K	3,52	6,00	3,77	3,84	0,338	HMV 150 E	95 200
C 31/800 K	3,55	6,06	4,01	4,09	0,360	HMV 160 E	103 900
C 31/850 K	4,02	6,86	4,32	4,39	0,383	HMV 170 E	114 600
C 31/1000 K	3,69	6,30	4,97	5,04	0,450	HMV 200 E	145 800
Series C 32							
C 3224 K	2,46	4,20	0,69	0,76	0,054	HMV 24 E	6 000
C 3232 K	2,68	4,58	0,87	0,94	0,072	HMV 32 E	8 600
C 3234 K	3,87	6,60	0,96	1,03	0,076	HMV 34 E	9 400
C 3236 K	3,69	6,30	1,01	1,09	0,081	HMV 36 E	10 300
Series C 39							
C 3972 K	0,63	1,08	1,74	1,81	0,162	HMV 72 E	31 300
C 3976 K	1,06	1,81	1,88	1,95	0,171	HMV 76 E	33 500
C 3980K	0,74	1,27	1,93	2,00	0,180	HMV 80 E	36 700
C 3984 K	0,73	1,25	2,03	2,10	0,189	HMV 84 E	40 000
C 3988 K	1,05	1,79	2,16	2,23	0,198	HMV 88 E	42 500
C 3992 K	0,82	1,41	2,22	2,29	0,207	HMV 92 E	45 100
C 3996 K	1,18	2,01	2,37	2,44	0,216	HMV 96 E	48 600
C 39/500 K	0,95	1,63	2,43	2,50	0,225	HMV 100 E	51 500
C 39/530 K	0,73	1,25	2,52	2,59	0,239	HMV 106 E	56 200
C 39/560 K	0,96	1,64	2,70	2,78	0,252	HMV 112 E	61 200
C 39/600 K	1,00	1,71	2,89	2,96	0,270	HMV 120 E	67 300
C 39/630 K	1,05	1,80	3,03	3,11	0,284	HMV 126 E	72 900
C 39/670 K	1,44	2,46	3,31	3,38	0,302	HMV 134 E	79 500
C 39/710 K	0,81	1,39	3,35	3,42	0,320	HMV 142 E	87 700
C 39/750 K	1,06	1,80	3,59	3,66	0,338	HMV 150 E	95 200
C 39/800 K	1,13	1,93	3,83	3,90	0,360	HMV 160 E	103 900
C 39/850 K	1,09	1,85	4,06	4,14	0,383	HMV 170 E	114 600
C 39/900 K	1,00	1,70	4,26	4,34	0,405	HMV 180 E	124 100
C 39/950 K	1,04	1,77	4,50	4,57	0,428	HMV 190 E	135 700

* The quoted values are for hydraulic nuts, the thread diameter of which corresponds to the bore diameter of the bearing to be mounted and for applications with lightly oiled sliding surfaces

Note

The values given in **table 3** for the requisite oil pressure and the axial displacement s_s apply to bearings mounted on solid steel shafts for the first time. For the case 4 shown in **fig 5** on **page 29,** “Two sliding interfaces” (bearing on a withdrawal sleeve), the guideline values given in **table 3** do not apply as a smaller nut is used than that shown for the bearing in **table 3**. The requisite oil pressure can be calculated from

$$P_{req} = \frac{A_{req}}{A_{ref}} \cdot P_{ref}$$

where

P_{req} = requisite oil pressure for hydraulic nut used, MPa

P_{ref} = oil pressure specified for the standard hydraulic nut (➔ **table 3**), MPa

A_{req} = piston area of hydraulic nut used (➔ **table 3**), mm^2

A_{ref} = piston area of the specified standard hydraulic nut (➔ **table 3**), mm^2

Measuring inner ring expansion

Measuring inner ring expansion allows large size CARB bearings with a tapered bore to be mounted simply, quickly and accurately without measuring the radial internal clearance before and after mounting. The SKF SensorMount® Method uses a sensor, integrated into the CARB toroidal roller bearing inner ring, and a dedicated hand-held indicator (➔ **fig 7**).

The bearing is driven up the tapered seating using common SKF mounting tools. Information from the sensor is processed by the indicator. Inner ring expansion is displayed as the relationship between the clearance reduction (mm) and the bearing bore diameter (m).

Aspects like bearing size, smoothness, shaft material or design – solid or hollow do not need to be considered.

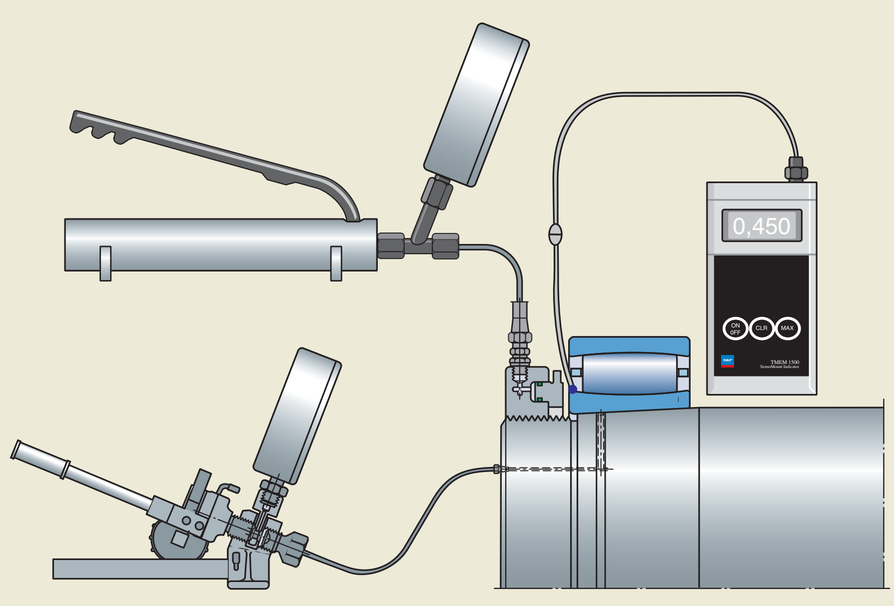
For detailed information about SKF SensorMount please contact SKF.

Additional mounting information

Additional information on mounting CARB toroidal roller bearings can be found

- in the handbook “SKF Drive-up Method” on CD-ROM,
- in the “SKF Interactive Engineering Catalogue” on CD-ROM or online at www.skf.com, or
- online at www.skf.com/mount.

Fig 7



Dismounting

If CARB toroidal roller bearings are to be re-used after dismounting, the force used for dismounting should never pass through the rollers. The ring with the looser fit should be withdrawn from its seating first. There are three methods available to dismount the bearing ring that has been mounted with an interference fit: mechanical, hydraulic or the oil injection method.

Detailed information on the dismounting of bearings is contained in publication 4100 "SKF Bearing Maintenance Handbook".

Dismounting from a cylindrical seating

CARB toroidal roller bearings having a bore diameter up to approximately 120 mm that have been mounted with an interference fit on the shaft can be removed using a conventional puller. The puller should be applied to the face of the ring to be dismounted (➔ **fig** 1). By turning the puller spindle the bearing is easily removed from the cylindrical seating.

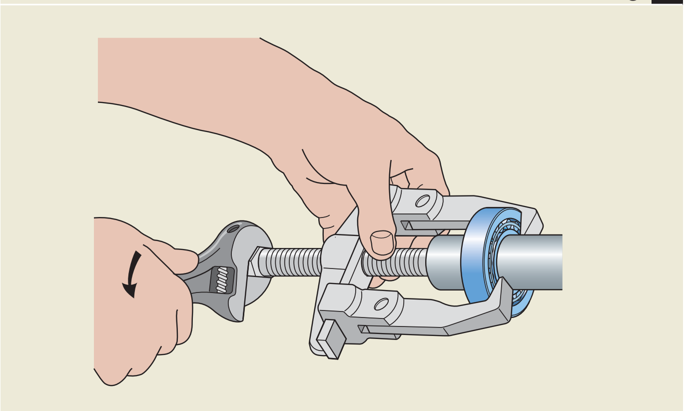
For larger bearings, the withdrawal forces are considerable. In these cases, the use of pullers with hydraulic assistance (➔ **fig** 2) or the SKF oil injection method should be used.

CARB toroidal roller bearings that have an interference fit for both rings should be pressed out of the housing together with the shaft. On the other hand it is also possible to withdraw the bearing with the housing from the shaft, particularly if the oil injection method is applied (➔ **fig** 3).

Small CARB toroidal roller bearings mounted with an interference fit in a housing bore without shoulders can be removed using a dolly applied to the outer ring. Larger bearings require more force to remove them and a press is required.

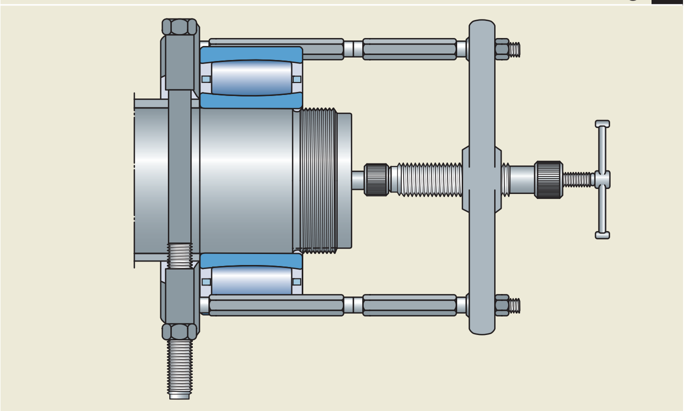
The puller is applied to the side face of the inner ring

Fig 1



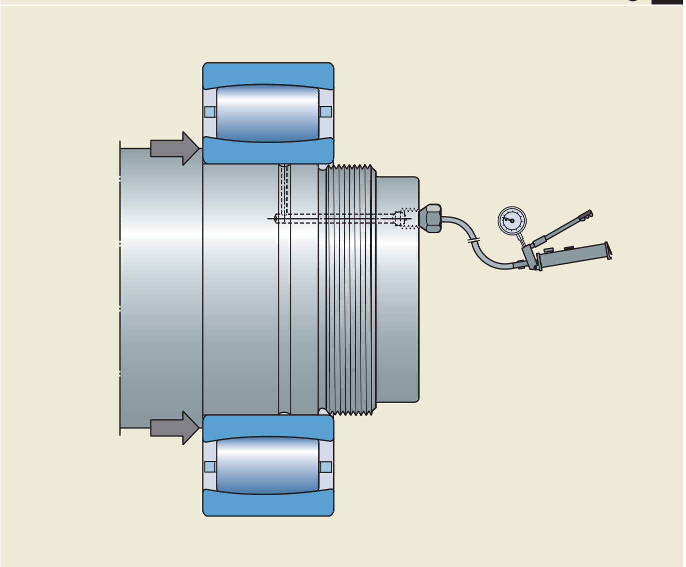
SKF puller with hydraulic assistance

Fig 2



CARB toroidal roller bearing on a cylindrical seating being removed using the oil injection method

Fig 3



Various larger CARB toroidal roller bearings that have a loose or a transition fit in the housing can be removed using a tool with hooks that pass between the rollers and grip the outer ring from behind (➔ **fig** 4), so that the withdrawal forces are applied directly to the outer ring and the rollers do not become jammed between the rings.

Dismounting from a tapered seating

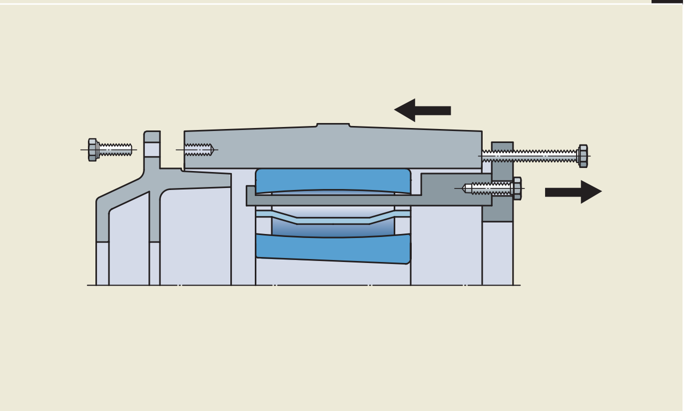
As bearings with a tapered bore come free from their seating very suddenly it is necessary to provide a stop of some sort to limit their axial movement. An end plate screwed to a shaft end or a lock nut (➔ **fig** 5) serve this purpose. The lock nut should be unscrewed a few turns.

Small CARB toroidal roller bearings can be removed with the aid of a dolly or a drift of special design (➔ **fig** 6). A few blows directed at the dolly are sufficient to drive the inner ring from its tapered seating.

Medium-sized CARB toroidal roller bearings can be withdrawn using a mechanical puller or a puller with a hydraulic assistance. To avoid damaging the bearing, the puller should be applied centrically.

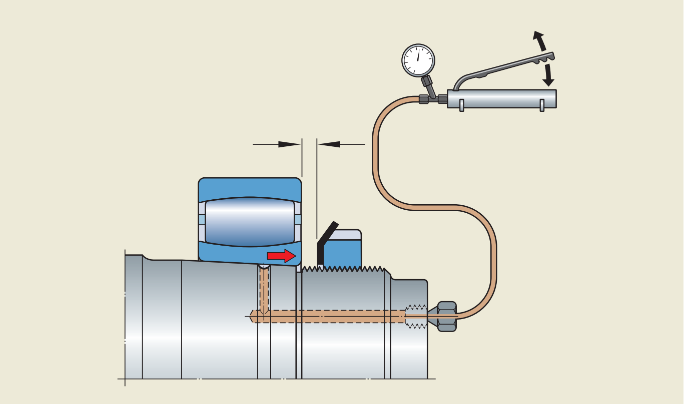
The removal of large bearings is greatly facilitated if the oil injection method is employed.

Fig 4



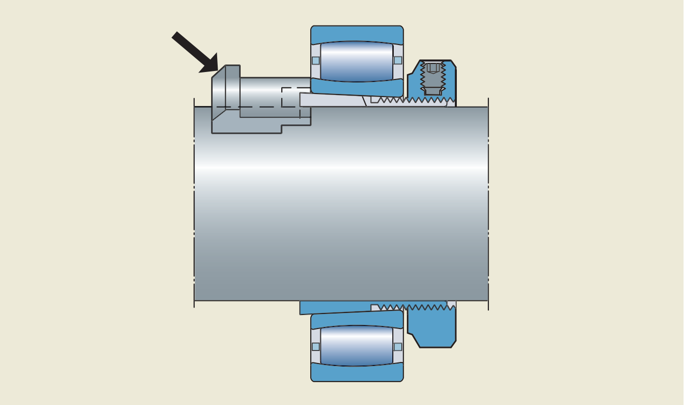
Schematic sketch of tool for removal of CARB bearings from a non-split housing

Fig 5



The lock nut is left on the shaft thread to provide a stop

Fig 6



Removal of a small CARB toroidal roller bearing using a drift of special design

SKF concept for cost saving

A daily occurrence

Whatever the branch of industry – unplanned stoppages are still not a thing of the past. They are not only annoying, but costly too. And with the heightened demands for prompt and just-in-time deliveries they may be even more expensive.

The SKF answer

The bearings in a machine can be likened to the heart of a living being. When the bearing comes to a standstill, the machine does too.

And just as a doctor will listen to the heart of a patient, so it is possible to listen to the bearings in order to judge the condition of the machine. It is possible to determine whether the bearing is in danger of failing prematurely because of faulty mounting, poor lubrication or other causes.

If the importance of the bearings is neglected this will inevitably lead to high costs, unnecessary stoppages and, in the worst case, damage to other components of the machine.

Instead, SKF recommends to make use of one of its services: an IMS (Integrated Maintenance Solutions) contract, which consists of linking customers with SKF resources.

This involves a multi-stage programme that includes the following points:

- common problem definition and target setting,
- optimization of spares stocked,
- reduction of purchasing costs,
- choosing the right bearings,
- caring for the bearings,
- monitoring the machine condition,
- having the correct tools and lubricants on hand,
- customer-specific training, and
- a repair service.

Obviously it is possible to accept the whole programme or to select only parts of it. Whatever the choice, it will be a win-win situation. More information can be obtained from the nearest SKF office or authorised distributor.

Monitoring temperature

Monitoring noise

SKF experts bring their experience to lubricant analysis

Bearing data – general

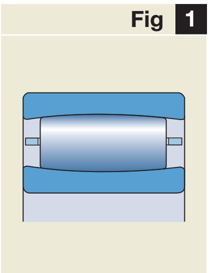
Designs

CARB toroidal roller bearings are available

- with a caged roller assembly (➔ **fig 1**) and
- in a full complement version (➔ **fig 2**).

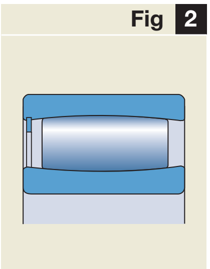
They are both produced with a cylindrical bore, but the caged bearings are also produced with a tapered bore. Depending on the bearing series, the taper is either 1:12 or 1:30.

Fig 1



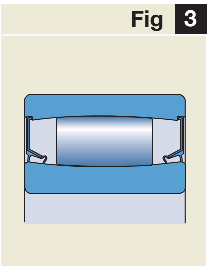
Caged CARB toroidal roller bearing

Fig 2



Full complement CARB toroidal roller bearing

Fig 3



Sealed CARB toroidal roller bearing

Sealed bearings

Today, the range of sealed bearings (➔ **fig 3**) consists of small and medium size full complement bearings for low speeds. These bearings with seals on both sides are filled with a high temperature long life grease and are maintenance-free.

The double lip seal suitable for high temperature operations is sheet steel reinforced and made of hydrogenated acrylonitrile butadiene rubber (HNBR). It seals against the inner ring raceway. The outside diameter of the seal is retained in an outer ring recess and provides proper sealing also in applications with outer ring rotation. The seals can withstand operating temperatures in the range of –40 and +150 °C.

The sealed bearings are filled with a premium quality, synthetic ester oil based grease using polyurea as a thickener. This grease has good corrosion inhibiting properties and can be used at temperatures between –25 and +180 °C. The base oil viscosity is 440 mm^2/s at 40 °C and 38 mm^2/s at 100 °C. The grease fill is 70 to 100 % of the free space in the bearing.

Sealed bearings with other lubricating greases or degrees of greasefill can be supplied on request.

Dimensions

The boundary dimensions of CARB toroidal roller bearings are in accordance with ISO 15:1998. The dimensions of the adapter and withdrawal sleeves correspond to ISO 2982-1:1995.

Tolerances

SKF CARB bearings are manufactured as standard to Normal tolerances. Bearings up to and including 300 mm bore diameter are produced to higher precision than the ISO Normal tolerances. For example

- the width tolerance is considerably tighter than the ISO Normal tolerance,
- the running accuracy is to tolerance class P5 as standard.

For larger bearing arrangements where running accuracy is a key operational parameter, SKF CARB bearings with P5 running accuracy are also available. These bearings are identified by the suffix C08. Their availability should be checked.

The values of the tolerances are in accordance with ISO 492:2002.

Internal clearance

CARB toroidal roller bearings are produced as standard with Normal radial internal clearance. Many of the bearings are also available with C3 clearance and some with the smaller C2 or the much larger C4 clearance.

The radial internal clearance limits for

- bearings with cylindrical bore are given in **table 1** on **page 38** and for
- bearings with tapered bore in **table 2** on **page 39**.

They are valid for bearings before mounting and under zero measuring load.

Axial displacement of one ring in relation to the other will gradually reduce the radial internal clearance in a CARB toroidal roller bearing. However, for the amount of axial displacement found in standard applications, this is not an issue.

CARB toroidal roller bearings are often used together with spherical roller bearings. In these cases the operational internal clearance of both the bearings should be the same.

Table 1

Radial internal clearance of CARB toroidal roller bearings with cylindrical bore

Bore diameter d over	incl.	Radial internal clearance C2 min	max	Normal min	max	C3 min	max	C4 min	max	C5 min	max
mm		µm									
18	**24**	15	27	27	39	39	51	51	65	65	81
24	**30**	18	32	32	46	46	60	60	76	76	94
30	**40**	21	39	39	55	55	73	73	93	93	117
40	**50**	25	45	45	65	65	85	85	109	109	137
50	**65**	33	54	54	79	79	104	104	139	139	174
65	**80**	40	66	66	96	96	124	124	164	164	208
80	**100**	52	82	82	120	120	158	158	206	206	258
100	**120**	64	100	100	144	144	186	186	244	244	306
120	**140**	76	119	119	166	166	215	215	280	280	349
140	**160**	87	138	138	195	195	252	252	321	321	398
160	**180**	97	152	152	217	217	280	280	361	361	448
180	**200**	108	171	171	238	238	307	307	394	394	495
200	**225**	118	187	187	262	262	337	337	434	434	545
225	**250**	128	202	202	282	282	368	368	478	478	602
250	**280**	137	221	221	307	307	407	407	519	519	655
280	**315**	152	236	236	330	330	434	434	570	570	714
315	**355**	164	259	259	360	360	483	483	620	620	789
355	**400**	175	280	280	395	395	528	528	675	675	850
400	**450**	191	307	307	435	435	577	577	745	745	929
450	**500**	205	335	335	475	475	633	633	811	811	1 015
500	**560**	220	360	360	518	518	688	688	890	890	1 110
560	**630**	245	395	395	567	567	751	751	975	975	1 215
630	**710**	267	435	435	617	617	831	831	1 075	1 075	1 335
710	**800**	300	494	494	680	680	920	920	1 200	1 200	1 480
800	**900**	329	535	535	755	755	1 015	1 015	1 325	1 325	1 655
900	**1 000**	370	594	594	830	830	1 120	1 120	1 460	1 460	1 830
1 000	**1 120**	410	660	660	930	930	1 260	1 260	1 640	1 640	2 040
1 120	**1 250**	450	720	720	1 020	1 020	1 380	1 380	1 800	1 800	2 240

To obtain equal values for both bearings, the reduction of radial internal clearance in the CARB bearing, caused by axial displacement, must be taken into account. Therefore, the initial clearance of a CARB bearing will be greater than for a comparably sized spherical roller bearing in the same clearance class. The difference amounts to approximately half the value of the clearance zone of the spherical roller bearing. Axial displacement of the CARB inner ring relative to the outer ring by 6 to 8 % of the bearing width will reduce the operational clearance by approximately the same value.

Misalignment
An angular misalignment of 0,5° between the inner and outer rings can be accommodated by CARB toroidal roller bearings without any negative consequences for the bearing. This guideline value presupposes that

- the positions of the shaft and housing axes remain constant and
- the actual permissible axial displacement of the bearing rings is not exceeded.

Greater misalignments cause additional sliding movements to take place between the rollers and raceways. This will increase friction and shorten bearing service life. Therefore, the angular misalignment should preferably not exceed 1°. Also, the ability to compensate for misalignment when the bearing is stationary is limited and misalignment when the bearing is stationary under load should therefore be avoided.

Both misalignment and axial displacement cause the rollers to move towards the side faces of the bearing rings. Rollers should not protrude; hence there is a limit to the axial displacement. The influence of misalignment on permissible axial displacement can be determined (➔ “Axial displacement” on **page 40**). Misalignment in bearings with MB type cage should never exceed 0,5°.

Radial internal clearance of CARB toroidal roller bearings with tapered bore

Table 2

Bore diameter d		**Radial internal clearance** **C2**		**Normal**		**C3**		**C4**		**C5**	
over	incl.	min	max	min	max	min	max	min	max	min	max
mm		µm									
18	**24**	19	31	31	43	43	55	55	69	69	85
24	**30**	23	37	37	51	51	65	65	81	81	99
30	**40**	28	46	46	62	62	80	80	100	100	124
40	**50**	33	53	53	73	73	93	93	117	117	145
50	**65**	42	63	63	88	88	113	113	148	148	183
65	**80**	52	78	78	108	108	136	136	176	176	220
80	**100**	64	96	96	132	132	172	172	218	218	272
100	**120**	75	115	115	155	155	201	201	255	255	321
120	**140**	90	135	135	180	180	231	231	294	294	365
140	**160**	104	155	155	212	212	269	269	338	338	415
160	**180**	118	173	173	238	238	301	301	382	382	469
180	**200**	130	193	193	260	260	329	329	416	416	517
200	**225**	144	213	213	288	288	363	363	460	460	571
225	**250**	161	235	235	315	315	401	401	511	511	635
250	**280**	174	258	258	344	344	444	444	556	556	692
280	**315**	199	283	283	377	377	481	481	617	617	761
315	**355**	223	318	318	419	419	542	542	679	679	848
355	**400**	251	350	350	471	471	598	598	751	751	920
400	**450**	281	383	383	525	525	653	653	835	835	1 005
450	**500**	305	435	435	575	575	733	733	911	911	1 115
500	**560**	335	475	475	633	633	803	803	1 005	1 005	1 225
560	**630**	380	530	530	702	702	886	886	1 110	1 110	1 350
630	**710**	422	590	590	772	772	986	986	1 230	1 230	1 490
710	**800**	480	674	674	860	860	1 100	1 100	1 380	1 380	1 660
800	**900**	529	735	735	955	955	1 215	1 215	1 525	1 525	1 855
900	**1 000**	580	814	814	1 040	1 040	1 340	1 340	1 670	1 670	2 050
1 000	**1 120**	645	895	895	1 165	1 165	1 495	1 495	1 875	1 875	2 275
1 120	**1 250**	705	975	975	1 275	1 275	1 635	1 635	2 055	2 055	2 495

Axial displacement
CARB toroidal roller bearings can accomodate changes in shaft length within certain limits. The guideline values for axial displacement given in the product tables are valid provided there is

- a sufficiently large operational radial clearance in the bearing, and that
- the rings are not misaligned.

This means that the rollers (➔ **fig** 4) will not protrude from the bearing rings (**a**) or interfere with the retaining ring (**b**) or with the seal, if any.

If the axial movement exceeds 50 % of the permissible axial displacement capability s_1, it should be checked, whether the residual radial internal clearance is sufficiently large. The reduction of radial clearance C_{red} as a result of an axial displacement can be calculated using the equation shown in the section "Influence of radial operating clearance on the axial displacement capability".

If the axial movement exceeds 50 % of the axial displacement capability s_1 or s_2, and the misalignment attains approximately 0,5°, the actual axial displacement of the rollers should be checked additionally. The axial displacement of the rollers s_{mis} caused by misalignment of the bearing rings can be calculated using the equation shown in the following section "Influence of roller displacement on the axial displacement capability". For additional information please contact the SKF application engineering service.

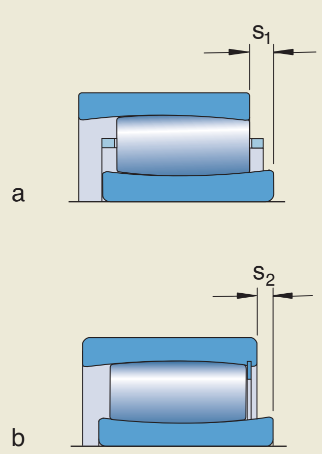
The maximum permissible axial displacement is obtained from the smaller of the minimum values of the

- permissible axial displacement s_{lim} depending on roller complement displacement, and the
- permissible axial displacement s_{cle} depending on the clearance reduction,

calculated as explained in the following part.

Axial displacement limits s_1 and s_2

Fig 4



Influence of roller displacement on axial displacement capability

The axial displacement, as well as the misalignment of one ring with respect to the other, changes the position of the roller complement in CARB bearing. The reduction in the permissible axial displacement caused by the misalignment can be estimated using

$$s_{mis} = k_1 \, B \, \alpha$$

where
s_{mis} = reduction in permissible axial displacement caused by misalignment, mm
k_1 = misalignment factor (➔ product tables)
B = bearing width, mm (➔ product tables)
α = misalignment, degrees

Assuming a sufficiently large operational clearance, the maximum permissible axial displacement is obtained from

$$s_{lim} = s_1 - s_{mis}$$

or

$$s_{lim} = s_2 - s_{mis}$$

where
s_{lim} = permissible axial displacement with respect to the roller complement caused by misalignment, mm
s_1 = guideline value for the axial displacement capability in bearings with cage, sealed bearings or full complement bearings when displacing away from the snap ring, mm (➔ product tables)
s_2 = guideline value for the axial displacement capability in full complement bearings when displacing towards the snap ring, mm (➔ product tables)
s_{mis} = reduction in permissible axial displacement caused by misalignment, mm

Influence of radial operating clearance on axial displacement capability

Axial displacement from a centred position of one bearing ring in relation to the other reduces the radial clearance. The radial clearance reduction corresponding to a certain axial displacement from a centred position can be calculated using

$$C_{red} = \frac{k_2 \, s_{cle}^2}{B}$$

The clearance reduction cannot be larger than the bearing operating radial clearance.

If instead a certain permissible radial clearance reduction is known, the corresponding permissible axial displacement from a centred position can be calculated using

$$s_{cle} = \sqrt{\frac{B \, C_{red}}{k_2}}$$

where
s_{cle} = axial displacement from a centred position giving a certain radial clearance reduction C_{red}, mm
C_{red} = reduction of radial clearance as a result of an axial displacement from a centred position, mm
k_2 = operating clearance factor (➔ product tables)
B = bearing width, mm

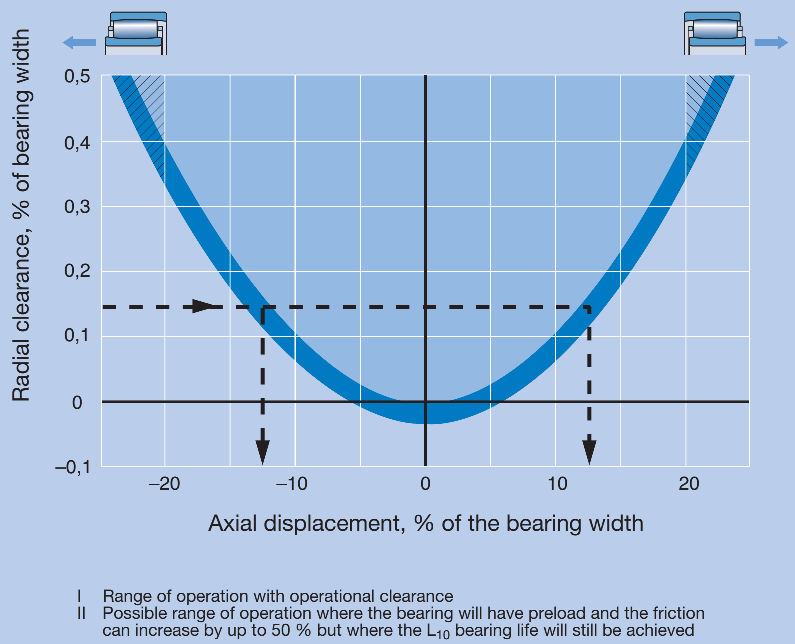
The axial displacement capability can also be obtained using **diagram** 1, which is valid for all CARB bearings. The axial displacement and operational clearance are shown as functions of the bearing width.

From **diagram 1** it can be seen (dotted line) that for a bearing C 3052 K/HA3C4, with an operational clearance of 0,15 mm which corresponds to approximately 0,15 % of the bearing width, an axial displacement of approximately 12,5 % of the bearing width is possible. Thus, when an axial displacement of approximately 0,125 × 104 = 13 mm has taken place, the operational clearance will be zero.

It should be remembered that the distance between the dotted line and the curve represents the residual radial operating clearance in the bearing arrangement.

Diagram 1 also illustrates how it is possible, simply by axially displacing the bearing rings relative to each other, to achieve a given radial internal clearance in a CARB bearing.

Diagram 1



Axial displacement in % of the bearing width as a function of radial operational clearance

Calculation example 1
For bearing C 3052 with a width B = 104 mm, a misalignment factor k_1 = 0,122 and a guideline value for the axial displacement capability s_1 = 19,3 mm for an angular misalignment α = 0,3°, the permis-sible axial displacement with respect to the roller complement movement caused by misalignment s_{lim} can be obtained from

$$s_{lim} = s_1 - k_1\, B\, \alpha$$

$$s_{lim} = 19{,}3 - 0{,}122 \times 104 \times 0{,}3 = 19{,}3 - 3{,}8$$

$$s_{lim} = 15{,}5 \text{ mm}$$

Calculation example 2
Bearing C 3052/HA3C4 has a width B = 104 mm, an operating clearance factor k_2 = 0,096 and an operational clearance of 0,15 mm. The possible axial displacement from the central position of one ring to the other until the operational clearance becomes zero is

$$s_{cle} = \sqrt{\frac{B\, C_{red}}{k_2}}$$

$$s_{cle} = \sqrt{\frac{104 \times 0{,}15}{0{,}096}} = 12{,}7 \text{ mm}$$

The axial displacement of 12,7 mm lies within the guideline value of s_1 = 19,3 mm (from the product tables) and is still permissible even if the rings should be misaligned at 0,3° to each other
(➔ **Calculation example 1**).

Calculation example 3
For bearing C 3052 that has a width of B = 104 mm and an operating clearance factor k_2 = 0,096 the reduction in operational clearance C_{red} caused by an axial displacement s_{cle} = 6,5 mm from the central position is calculated using

$$C_{red} = \frac{k_2\, s_{cle}^2}{B}$$

$$C_{red} = \frac{0{,}096 \times 6{,}5^2}{104}$$

$$C_{red} = 0{,}039 \text{ mm}$$

Cages

Depending on their size, CARB toroidal bearings are fitted with one of the following as standard (➔ **fig** 5):

- injection moulded cage of glass fibre reinforced polyamide 4,6, roller centred, designation suffix TN9 (**a**),
- window-type steel cage, roller centred, no designation suffix (**b**),
- window-type brass cage, roller centred, designation suffix M (**c**), or
- machined brass cage, inner ring centred, designation suffix MB (**d**).

CARB bearings with polyamide 4,6 cages can be operated at temperatures up to +120 °C. With the exception of a few synthetic oils and greases with a synthetic oil base, and lubricants containing a high proportion of EP additives when used at high temperatures, the lubricants generally used for rolling bearings do not have a detrimental effect on cage properties.

For bearing arrangements that are to be operated at continuously high temperatures or under arduous conditions, SKF recommends using steel or brass cages.

Influence of operating temperature on bearing material

All CARB bearing rings undergo a special heat treatment so that they can operate at higher temperatures for extended periods without causing detrimental dimensional changes. Of course, the maximum temperature is dependant on the cage, lubricant and seals, However, the rings are heat treated to withstand 200 °C for 2 500 h, or for short periods, even higher temperatures.

Minimum load

In order to provide satisfactory operation, CARB toroidal roller bearings, like all ball and roller bearings, must always be subjected to a given minimum load, particularly if they are to operate at high speeds or are subjected to high accelerations or rapid changes in the direction of load. Under such conditions the inertia forces of rollers and cage, and the friction in the lubricant, can have a detrimental effect on the rolling conditions in the bearing arrangement and may cause damaging sliding movements to occur between the rollers and the raceways.

The requisite minimum load to be applied to a CARB toroidal roller bearing with cage can be estimated using

$$P_{0m} = 0{,}007\, C_0$$

and for a full complement bearing using

$$P_{0m} = 0{,}01\, C_0$$

where

P_{0m} = minimum equivalent static load, kN

C_0 = basic static load rating, kN (➔ product tables)

In some applications it is not possible to obtain the requisite minimum load. However, for caged bearings that are oil lubricated, lower minimum loads are permissible. These loads can be calculated when $n/n_r \leq 0{,}3$ from

$$P_{0m} = 0{,}002\, C_0$$

and when $0{,}3 < n/n_r \leq 2$ from

$$P_{0m} = 0{,}002\, C_0 \left(1 + 2\sqrt{\frac{n}{n_r} - 0{,}3}\right)$$

where

P_{0m} = minimum equivalent static bearing load, kN

C_0 = basic static load rating, kN (➔ product tables)

n = rotational speed, r/min

n_r = reference speed, r/min (➔ product tables)

When starting up at low temperatures or when the lubricant is highly viscous, even greater minimum loads than $P_{0m} = 0{,}007\, C_0$ and $0{,}01\, C_0$ respectively may be required. The weight of the components supported by the bearing, together with external forces, generally exceeds the requisite minimum load. If this is not the case, the CARB bearing must be subjected to an additional radial load.

Equivalent dynamic bearing load

For CARB toroidal roller bearings

$$P = F_r$$

Equivalent static bearing load

For CARB toroidal roller bearings

$$P_0 = F_r$$

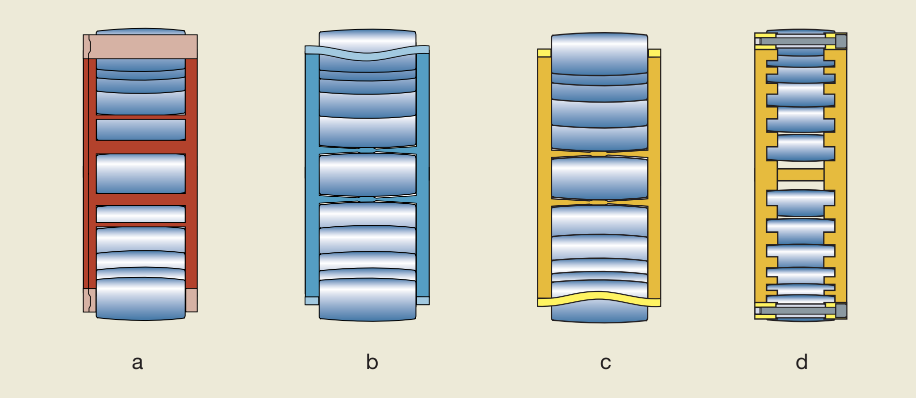
CARB bearings on adapter sleeves

For CARB bearings with a tapered bore, SKF also supplies adapter sleeves (➔ **fig** 6) and withdrawal sleeves. These enable the bearings to be quickly and easily secured on smooth or stepped shafts. Detailed information on CARB bearings on adapter sleeves can be found in the product table starting on **page 58**.

Where appropriate, modified adapter sleeves of the E, L and TL designs, e.g. H 310 E, are available for CARB toroidal roller bearings, to prevent the locking device from fouling the cage. With adapter sleeves of

- series H … E, the standard lock nut with locking washer (KM + MB) is replaced by a KMFE lock nut (➔ **fig** 7),

Fig 5



Cages for CARB bearings

Designation scheme

- series OH … HE the standard lock nut HM is replaced by a HME nut with a changed front face (➔ **fig** 8),
- L-design differs from the standard design in that the standard lock nut KM and locking washer MB have been replaced by a KML nut with MBL locking washer; these have a lower sectional height (➔ **fig** 9),
- TL-design, the standard HM 31 lock nut with MS 31 locking clip have been replaced with the corresponding HM 30 nut and MS 30 locking clip; these have a lower sectional height.

CARB bearing on adapter sleeve

Fig 6

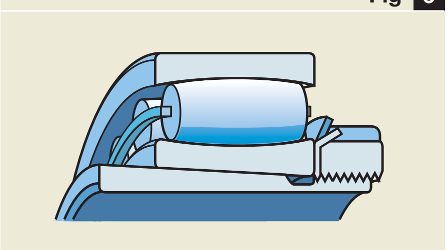
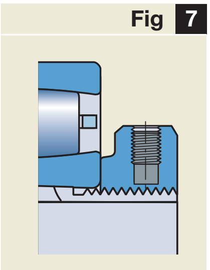
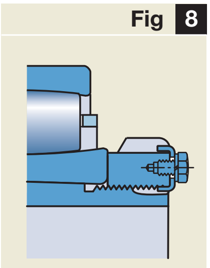


Fig 7



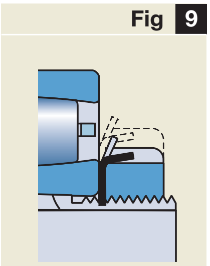
Sleeve of series H … E with a KMFE lock nut

Fig 8



Sleeve of series OH … HE with a modified HME lock nut

Fig 9



Sleeve of series H … L with a KML lock nut plus an MBL locking washer

Diagram 2

Examples

C 2215 TN9/C3	C	22	15		TN9/C3
C 3160 K/HA3C4	C	31	60	K	HA3C4

Prefix

C	Bearing with standardised dimensions
BSC-	Special bearing

ISO-Dimension Series

39, 49, 59, 69	ISO Diameter Series 9
30, 40, 50, 60	ISO Diameter Series 0
31, 41	ISO Diameter Series 1
22, 32	ISO Diameter Series 2
23	ISO Diameter Series 3

Size identification

05 × 5	25 mm bore diameter
to	
96 × 5	480 mm bore diameter
from	
/500	Bore diameter uncoded in millimetres

Bore

–	Cylindrical bore
K	Tapered bore, taper 1:12
K30	Tapered bore, taper 1:30

Other features

–	Steel window-type cage
–	Normal radial internal clearance
C1	Radial internal clearance smaller than C2
C2	Radial internal clearance smaller than Normal
C3	Radial internal clearance greater than Normal
C4	Radial internal clearance greater than C3
C5	Radial internal clearance greater than C4
2CS	Sheet steel reinforced nitrile rubber seals (NBR) on both sides of the bearing[1)]
2CS5	Sheet steel reinforced hydrogenated nitirile rubber seals (HNBR) on both sides of the bearing[2)]
HA3	Case hardened inner ring
M	Machined brass window-type cage
MB	Machined inner ring centred brass cage
2NS	Highly efficient nitrile rubber seals on both sides of the bearing[2)]
TN9	Injection moulded cage of glass fibre reinforced polyamide 4,6
V	Full complement of rollers (no cage)
VG114	Surface hardened pressed steel cage
VE240	Bearing modified for greater axial displacement

1) Bearings with CS seals are filled to 40 % of the free space in the bearing
2) Bearings with CS5 seals as well as with NS seals are filled to between 70 and 100 % of the free space in the bearing

Designation scheme for CARB toroidal roller bearings

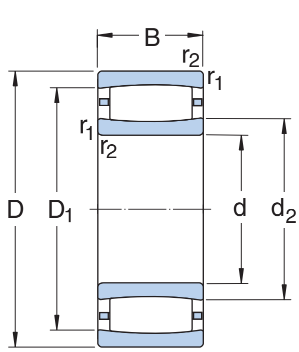
Designation

The complete designation of a CARB toroidal roller bearing is made up of

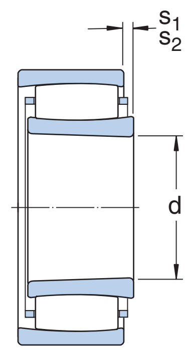
- the prefix C,
- the ISO Dimension Series identification,
- the size identification, and
- any supplementary designations used to identify certain features of the bearing.

Diagram 2 shows the designation scheme and the meaning of the various letters and figures in the order in which they appear.

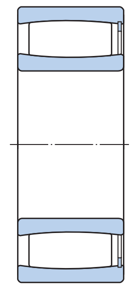
CARB toroidal roller bearings
d **25 – 60** mm



Cylindrical bore



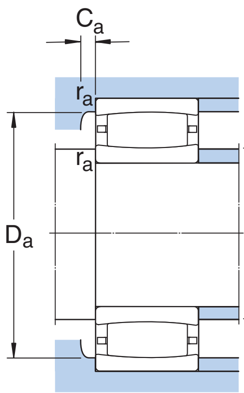
Tapered bore

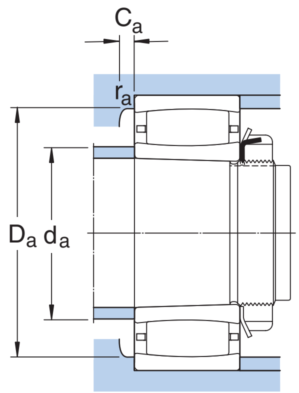


Full complement

Principal dimensions d	D	B	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Speed ratings Reference speed	Limiting speed	Mass	Designations Bearing with cylindrical bore	tapered bore
mm			kN		kN	r/min		kg	–	
25	52	18	44	40	4,55	13 000	18 000	0,17	▶ **C 2205 TN9**	▶ **C 2205 KTN9**
	52	18	58,5	50	5,5	–	7 000	0,18	▶ **C 2205 V**	▶ **C 2205 KV**
30	55	45	134	180	19,6	–	3 000	0,50	**C 6006 V**	**–**
	62	20	69,5	62	7,2	11 000	15 000	0,27	**C 2206 TN9**	**C 2206 KTN9**
	62	20	76,5	71	8,3	–	6 000	0,29	**C 2206 V**	**C 2206 KV**
35	72	23	83	80	9, 3	9 500	13 000	0,43	**C 2207 TN9**	**C 2207 KTN9**
	72	23	95	96,5	11,2	–	5 000	0,45	**C 2207 V**	**C 2207 KV**
40	62	22	76,5	100	11	–	4 300	0,25	**C 4908 V**	**C 4908 K30V**
	62	30	104	143	16	–	3 400	0,35	▶ **C 5908 V**	**–**
	62	40	122	180	19,3	–	2 800	0,47	▶ **C 6908 V**	**–**
	80	23	90	86,5	10,2	8 000	11 000	0,50	**C 2208 TN9**	**C 2208 KTN9**
	80	23	102	104	12	–	4 500	0,53	**C 2208 V**	**C 2208 KV**
45	68	22	81,5	112	12,9	–	3 800	0,30	▶ **C 4909 V**	▶ **C 4909 K30V**
	68	30	110	163	18,3	–	3 200	0,41	▶ **C 5909 V**	**–**
	68	40	132	200	22	–	2 600	0,55	▶ **C 6909 V**	**–**
	85	23	93	93	10,8	8 000	11 000	0,55	**C 2209 TN9**	**C 2209 KTN9**
	85	23	106	110	12,9	–	4 300	0,58	**C 2209 V**	**C 2209 KV**
50	72	22	86,5	125	13,7	–	3 600	0,29	**C 4910 V**	**C 4910 K30V**
	72	30	118	180	20,4	–	2 800	0,42	▶ **C 5910 V**	**–**
	72	40	140	224	24,5	–	2 200	0,54	**C 6910 V**	**–**
	80	30	116	140	16	5 000	7 500	0,55	**C 4010 TN9**	**C 4010 K30TN9**
	80	30	137	176	20	–	3 000	0,59	**C 4010 V**	**C 4010 K30V**
	90	23	98	100	11,8	7 000	9 500	0,59	**C 2210 TN9**	**C 2210 KTN9**
	90	23	114	122	14,3	–	3 800	0,62	**C 2210 V**	**C 2210 KV**
55	80	25	106	153	18	–	3 200	0,43	▶ **C 4911 V**	▶ **C 4911 K30V**
	80	34	143	224	25	–	2 600	0,60	▶ **C 5911 V**	**–**
	80	45	180	300	32,5	–	2 000	0,81	▶ **C 6911 V**	**–**
	100	25	116	114	13,4	6 700	9 000	0,79	**C 2211 TN9**	**C 2211 KTN9**
	100	25	132	134	16	–	3 400	0,81	**C 2211 V**	**C 2211 KV**
60	85	25	112	170	19,6	–	3 000	0,46	▶ **C 4912 V**	▶ **C 4912 K30V**
	85	34	150	240	26,5	–	2 400	0,64	▶ **C 5912 V**	**–**
	85	45	190	335	36	–	1 900	0,84	**C 6912 V**	**–**
	110	28	143	156	18,3	5 600	7 500	1,10	**C 2212 TN9**	**C 2212 KTN9**
	110	28	166	190	22,4	–	2 800	1,15	**C 2212 V**	**C 2212 KV**

▶ Please check availability of the bearing before incorporating it in a bearing arrangement design

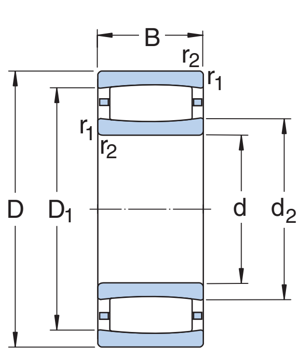




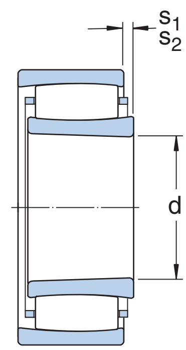
Dimensions						**Abutment and fillet dimensions**						**Calculation factors**	
d	d_2 ≈	D_1 ≈	$r_{1,2}$ min	s_1[1] ≈	s_2[1] ≈	d_a min	d_a[2] max	D_a[3] min	D_a max	C_a[4] min	r_a max	k_1	k_2
mm						min						–	
25	32,1	43,3	1	5,8	–	30,6	32	42	46,4	0,3	1	0,09	0,126
	32,1	43,3	1	5,8	2,8	30,6	39	–	46,4	–	1	0,09	0,126
30	38,5	47,3	1	7,9	4,9	35,6	43	–	49,4	–	1	0,102	0,096
	37,4	53,1	1	4,5	–	35,6	37	51	56,4	0,3	1	0,101	0,111
	37,4	53,1	1	4,5	1,5	35,6	49	–	56,4	–	1	0,101	0,111
35	44,8	60,7	1,1	5,7	–	42	44	59	65	0,1	1	0,094	0,121
	44,8	60,7	1,1	5,7	2,7	42	57	–	65	–	1	0,094	0,121
40	46,1	55,3	0,6	4,7	1,7	43,2	52	–	58,8	–	0,6	0,099	0,114
	45,8	54,6	0,6	5	2	43,2	45	–	58,8		0,6	0,096	0,106
	46,6	53,8	0,6	9,4	6,4	43,2	46	–	58,8		0,6	0,113	0,088
	52,4	69,9	1,1	7,1	–	47	52	68	73	0,3	1	0,093	0,128
	52,4	69,9	1,1	7,1	4,1	47	66	–	73	–	1	0,093	0,128
45	51,6	60,5	0,6	4,7	1,7	48,2	51	–	64,8	–	0,6	0,114	0,1
	51,3	60,1	0,6	5	2	48,2	51	–	64,8	–	0,6	0,096	0,108
	52,1	59,3	0,6	9,4	6,4	48,2	52	–	64,8	–	0,6	0,113	0,09
	55,6	73,1	1,1	7,1	–	52	55	71	78	0,3	1	0,095	0,128
	55,6	73,1	1,1	7,1	4,1	52	69	–	78	–	1	0,095	0,128
50	56,9	66,1	0,6	4,7	1,7	53,2	62	–	68,8	–	0,6	0,103	0,114
	56,8	65,7	0,6	5	2	53,2	56	–	68,8	–	0,6	0,096	0,11
	57,5	65	0,6	9,4	6,4	53,2	61	–	68,8	–	0,6	0,093	0,113
	57,6	70,8	1	6	–	54,6	57	69	75,4	0,1	1	0,103	0,107
	57,6	70,8	1	6	3	54,6	67	–	75,4	–	1	0,103	0,107
	61,9	79,4	1,1	7,1	–	57	61	77	83	0,8	1	0,097	0,128
	61,9	79,4	1,1	7,1	3,9	57	73	–	83	–	1	0,097	0,128
55	62	72,1	1	5,5	2,5	59,6	62	–	80,4	–	1	0,107	0,105
	62,8	72,4	1	6	3	59,6	62	–	80,4	–	1	0,097	0,109
	62,8	71,3	1	7,9	4,9	59,6	62	–	80,4	–	1	0,096	0,105
	65,8	86,7	1,5	8,6	–	64	65	84	91	0,3	1,5	0,094	0,133
	65,8	86,7	1,5	8,6	5,4	64	80	–	91	–	1,5	0,094	0,133
60	68	78,2	1	5,5	2,3	64,6	68	–	80,4	–	1	0,107	0,108
	66,8	76,5	1	6	2,8	64,6	66	–	80,4	–	1	0,097	0,11
	68,7	77,5	1	7.9	4,7	64,6	72	–	80,4	–	1	0,108	0,096
	77,1	97,9	1,5	8,5	–	69	77	95	101	0,3	1,5	0,1	0,123
	77,1	97,9	1,5	8,5	5,3	69	91	–	101	–	1,5	0,1	0,123

[1] Permissible axial displacement from normal position of one bearing ring in relation to the other (→ **page 40**)
[2] To clear the cage for caged bearings or to clear the snap ring for full complement bearings
[3] To clear the cage for caged bearings
[4] Minimum width of free space for bearings with cage in normal position (→ **page 18**)

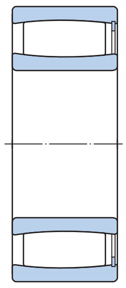
CARB toroidal roller bearings
d **65 – 95** mm



Cylindrical bore



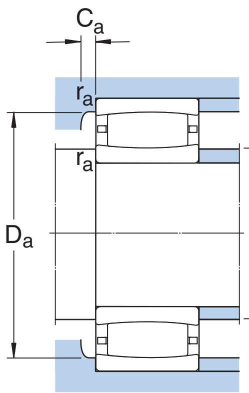
Tapered bore

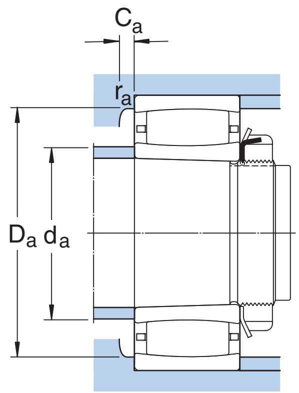


Full complement

Principal dimensions d	D	B	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Speed ratings Reference	Limiting speed	Mass	Designations Bearing with cylindrical bore	tapered bore
mm			kN		kN	r/min		kg	–	
65	90	25	116	180	20,8	–	2 800	0,50	► **C 4913 V**	► **C 4913 K30V**
	90	34	156	260	30	–	2 200	0,70	► **C 5913 V**	**–**
	90	45	196	355	38	–	1 800	0,93	► **C 6913 V**	**–**
	100	35	196	275	32	–	2 400	1,00	► **C 4013 V**	► **C 4013 K30V**
	120	31	180	180	21,2	5 300	7 500	1,40	**C 2213 TN9**	**C 2213 KTN9**
	120	31	204	216	25,5	–	2 400	1,47	**C 2213 V**	**C 2213 KV**
70	100	30	163	240	28	–	2 600	0,78	► **C 4914 V**	► **C 4914 K30V**
	100	40	196	310	34,5	–	2 000	1,00	► **C 5914 V**	**–**
	100	54	265	455	49	–	1 700	1,40	► **C 6914 V**	**–**
	125	31	186	196	23,2	5 000	7 000	1,45	**C 2214 TN9**	**C 2214 KTN9**
	125	31	212	228	27	–	2 400	1,50	**C 2214 V**	**C 2214 KV**
	150	51	405	430	49	3 800	5 000	4,25	**C 2314**	**C 2314 K**
75	105	30	166	255	30	–	2 400	0,82	► **C 4915 V**	► **C 4915 K30V**
	105	40	204	325	37,5	–	1 900	1,10	**C 5915 V**	**–**
	105	54	204	325	37,5	–	1 600	1,40	**C 6915 V/VE240**	**–**
	115	40	236	345	40	–	2 000	1,50	► **C 4015 V**	► **C 4015 K30V**
	130	31	196	208	25,5	4 800	6 700	1,60	**C 2215**	**C 2215 K**
	130	31	220	240	29	–	2 200	1,65	**C 2215 V**	**C 2215 KV**
	160	55	425	465	52	3 600	4 800	5,20	**C 2315**	**C 2315 K**
80	110	30	173	275	31,5	–	2 200	0,87	► **C 4916 V**	► **C 4916 K30V**
	110	40	208	345	40	–	1 800	1,20	► **C 5916 V**	**–**
	140	33	220	250	28,5	4 500	6 000	2,00	**C 2216**	**C 2216 K**
	140	33	255	305	34,5	–	2 000	2,10	**C 2216 V**	**C 2216 KV**
	170	58	510	550	61	3 400	4 500	6,20	**C 2316**	**C 2316 K**
85	120	35	224	355	40,5	–	2 000	1,30	► **C 4917 V**	► **C 4917 K30V**
	120	46	275	465	52	–	1 700	1,70	► **C 5917 V**	**–**
	150	36	275	320	36,5	4 300	5 600	2,60	**C 2217**	**C 2217 K**
	150	36	315	390	44	–	1 800	2,80	**C 2217 V**	**C 2217 KV**
	180	60	540	600	65,5	3 200	4 300	7,30	**C 2317**	**C 2317 K**
90	125	35	186	315	35,5	–	2 000	1,30	► **C 4918 V**	► **C 4918 K30V**
	125	46	224	400	44	–	1 600	1,75	**C 5918 V**	**–**
	150	72	455	670	73,5	–	1 500	5,10	**BSC-2039 V**	**–**
	160	40	325	380	42,5	3 800	5 300	3,30	**C 2218**	► **C 2218 K**
	160	40	365	440	49	–	1 500	3,40	**C 2218 V**	► **C 2218 KV**
	190	64	610	695	73,5	2 800	4 000	8,50	**C 2318**	► **C 2318 K**
95	170	43	360	400	44	3 800	5 000	4,00	► **C 2219**	► **C 2219 K**
	200	67	610	695	73,5	2 800	4 000	10,0	**C 2319**	**C 2319 K**

► Please check availability of the bearing before incorporating it in a bearing arrangement design

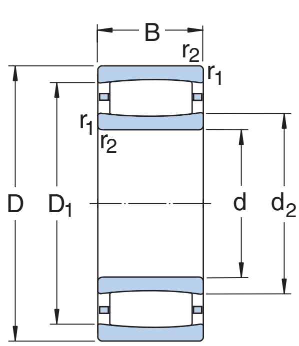




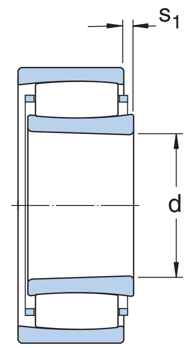
Dimensions						**Abutment and fillet dimensions**						**Calculation factors**	
d	d_2 ≈	D_1 ≈	$r_{1,2}$ min	s_1 [1] ≈	s_2 [1] ≈	d_a min	d_a [2] max	D_a [3] min	D_a max	C_a [4] min	r_a max	k_1	k_2
mm						mm						–	
65	72,1	82,2	1	5,5	2,3	69,6	72	–	85,4	–	1	0,107	0,109
	72,9	82,6	1	6	2,8	69,6	72	–	85,4	–	1	0,097	0,111
	72,9	81,4	1	7,9	4,7	69,6	72	–	85,4	–	1	0,096	0,107
	74,2	89,1	1,1	6	2,8	71	74	–	94	–	1	0,1	0,108
	79	106	1,5	9,6	–	74	79	102	111	0,2	1,5	0,097	0,127
	79	106	1,5	9,6	5,3	74	97	–	111	–	1,5	0,097	0,127
70	78	91	1	6	2,8	74,6	78	–	95,4	–	1	0,107	0,107
	78,7	90,3	1	9,4	6,2	74,6	78	–	95,4	–	1	0,114	0,095
	79,1	89,8	1	9	5,8	74,6	79	–	95,4	–	1	0,102	0,1
	83,7	111	1,5	9,6	–	79	83	107	116	0,4	1,5	0.098	0,127
	83,7	111	1,5	9,6	5,3	79	102	–	116	–	1,5	0,098	0,127
	91,4	130	2,1	9,1	–	82	105	120	138	2,2	2	0,11	0,099
75	83,1	96,1	1	6	2,8	79,6	83	–	100	–	1	0,107	0,108
	83,6	95,5	1	9,4	6,2	79,6	89	–	100	–	1	0,098	0,114
	83,6	95,5	1	9,2	9,2	79,6	88	–	100	–	1	0,073	0,154
	87,6	104	1,1	9,4	5,1	81	87	–	109	–	1	0,115	0,097
	88,5	115	1,5	9,6	–	84	98	110	121	1,2	1,5	0,099	0,127
	88,5	115	1,5	9,6	5,3	84	105	–	121	–	1,5	0,099	0,127
	98,5	135	2,1	13,1	–	87	110	130	148	2,2	2	0,103	0,107
80	88,2	101	1	6	1,7	84,6	88	–	105	–	1	0,107	0,11
	88,8	101	1	9,4	5,1	84,6	88	–	105	–	1	0,114	0,098
	98,1	125	2	9,1	–	91	105	120	129	1,2	2	0,104	0,121
	98,1	125	2	9,1	4,8	91	115	–	129	–	2	0,104	0,121
	102	145	2,1	10,1	–	92	115	135	158	2,4	2	0,107	0,101
85	94,5	109	1,1	6	1,7	91	94	–	114	–	1	0,1	0,114
	95	109	1,1	8,9	4,6	91	95	–	114	–	1	0,098	0,109
	104	133	2	7,1	–	96	110	125	139	1,3	2	0,114	0,105
	104	133	2	7,1	1,7	96	115	–	139	–	2	0,114	0,105
	110	153	3	12,1	–	99	125	145	166	2,4	2,5	0,105	0,105
90	102	113	1,1	11	6,7	96	100	–	119	–	1	0,125	0,098
	102	113	1,1	15,4	11,1	96	105	–	119	–	1	0,089	0,131
	109	131	2	19,7	19,7	101	115	–	139	–	2	0,087	0,123
	112	144	2	9,5	–	101	120	130	149	1,4	2	0,104	0,117
	112	144	2	9,5	5,4	101	125	–	149	–	2	0,104	0,117
	119	166	3	9,6	–	104	135	155	176	2	2,5	0,108	0,101
95	113	149	2,1	10,5	–	107	112	149	158	4,2	2	0,114	0,104
	120	166	3	12,6	–	109	135	155	186	2,1	2,5	0,103	0,106

[1] Permissible axial displacement from normal position of one bearing ring in relation to the other (→ **page 40**)
[2] To clear the cage for caged bearings or to clear the snap ring for full complement bearings
[3] To clear the cage for caged bearings
[4] Minimum width of free space for bearings with cage in normal position (→ **page 18**)

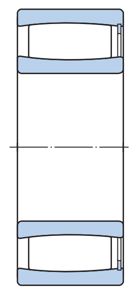
CARB toroidal roller bearings
d **100 – 160** mm



Cylindrical bore



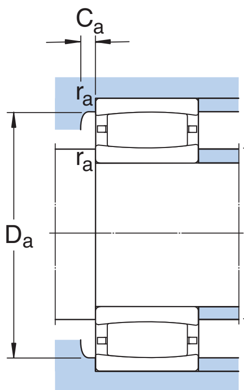
Tapered bore

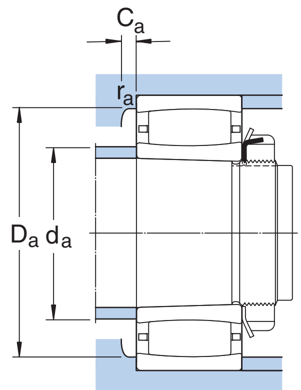


Full complement

Principal dimensions d	D	B	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Speed ratings Reference speed	Limiting speed	Mass	Designations Bearing with cylindrical bore	tapered bore
mm			kN		kN	r/min		kg	–	
100	140	40	275	450	49	–	1 700	1,90	▶ **C 4920 V**	▶ **C 4920 K30V**
	140	54	375	640	68	–	1 400	2,70	▶ **C 5920 V**	**–**
	150	50	355	530	57	–	1 400	3,05	**C 4020 V**	**C 4020 K30V**
	150	67	510	865	90	–	1 100	4,30	**C 5020 V**	**–**
	165	52	415	540	58,5	3 200	4 300	4,40	▶ **C 3120**	▶ **C 3120 K**
	165	52	475	655	69,5	–	1 300	4,40	**C 3120 V**	**–**
	165	65	475	655	69,5	–	1 300	5,25	**C 4120 V/VE240**	**C 4120 K30V/VE240**
	170	65	475	655	69,5	–	1 300	5,95	**BSC-2034 V**	**–**
	180	46	415	465	47,5	3 600	4 800	4,85	**C 2220**	**C 2220 K**
	215	73	800	880	91,5	2 600	3 600	12,5	**C 2320**	**C 2320 K**
110	170	45	355	480	51	3 200	4 500	3,50	▶ **C 3022**	▶ **C 3022 K**
	170	60	500	800	83	–	1 200	5,15	**C 4022 V**	**C 4022 K30V**
	180	69	670	1 000	102	–	900	7,05	**C 4122 V**	**C 4122 K30V**
	200	53	530	620	64	3 200	4 300	6,90	**C 2222**	**C 2222 K**
120	180	46	375	530	55	3 000	4 000	3,90	**C 3024**	**C 3024 K**
	180	46	430	640	67	–	1 400	4,05	**C 3024 V**	**C 3024 KV**
	180	60	530	880	90	–	1 100	5,50	**C 4024 V**	**C 4024 K30V**
	200	80	780	1 120	114	–	750	10,5	▶ **C 4124 V**	▶ **C 4124 K30V**
	215	58	610	710	72	3 000	4 000	8,60	▶ **C 2224**	▶ **C 2224 K**
	215	76	750	980	98	2 400	3 200	11,5	**C 3224**	**C 3224 K**
130	200	52	390	585	58,5	2 800	3 800	5,90	▶ **C 3026**	▶ **C 3026 K**
	200	69	620	930	91,5	1 900	2 800	7,84	**C 4026**	**C 4026 K30**
	200	69	720	1 120	112	–	850	8,05	**C 4026 V**	**C 4026 K30V**
	210	80	750	1 100	108	–	670	10,5	**C 4126 V/VE240**	**C 4126 K30V/VE240**
	230	64	735	930	93	2 800	3 800	11,0	**C 2226**	**C 2226 K**
140	210	53	490	735	72	2 600	3 400	6,30	▶ **C 3028**	▶ **C 3028 K**
	210	69	750	1 220	118	–	800	8,55	**C 4028 V**	**C 4028 K30V**
	225	85	1 000	1 600	153	–	630	14,2	**C 4128 V**	**C 4128 K30V**
	250	68	830	1 060	102	2 400	3 400	13,8	**C 2228**	**C 2228 K**
150	225	56	540	850	83	2 400	3 200	8,30	**C 3030 MB**	**C 3030 KMB**
	225	75	780	1 320	125	–	750	10,5	**C 4030 V**	**C 4030 K30V**
	250	80	880	1 290	122	2 000	2 800	15,0	**C 3130**	**C 3130 K**
	250	100	1 220	1 860	173	–	450	20,5	▶ **C 4130 V**	▶ **C 4130 K30V**
	270	73	980	1 220	116	2 400	3 200	17,5	**C 2230**	**C 2230 K**
160	240	60	600	980	93	2 200	3 000	9,60	▶ **C 3032**	▶ **C 3032 K**
	240	80	795	1 160	110	1 600	2 400	12,3	**C 4032**	**C 4032 K30**
	240	80	915	1 460	140	–	600	12,6	**C 4032 V**	**C 4032 K30V**
	270	86	1 000	1 400	132	2 000	2 600	20,0	▶ **C 3132**	▶ **C 3132 K**
	270	109	1 460	2 160	200	–	300	26,0	▶ **C 4132 V**	▶ **C 4132 K30V**
	290	104	1 370	1 830	170	1 700	2 400	28,5	**C 3232**	**C 3232 K**

▶ Please check availability of the bearing before incorporating it in a bearing arrangement design
[1] Also available in design K/HA3C4

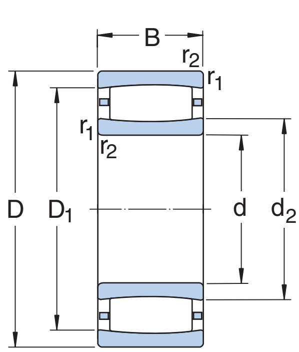




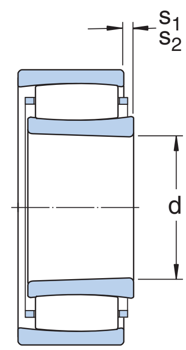
Dimensions						Abutment and fillet dimensions						Calculation factors	
d	d_2 ≈	D_1 ≈	$r_{1,2}$ min	s_1[1] ≈	s_2[1] ≈	d_a min	d_a[2] max	D_a[3] min	D_a max	C_a[4] min	r_a max	k_1	k_2
mm						mm						–	
100	113	130	1,1	9,4	5,1	106	110	–	134	–	1	0,115	0,103
	110	127	1,1	9	4,7	106	105	–	134	–	1	0,103	0,105
	113	135	1,5	14	9,7	109	120	–	141	–	1,5	0,098	0,118
	114	136	1,5	9,3	5	109	125	–	141	–	1,5	0,112	0,094
	119	150	2	10	–	111	119	150	154	4,5	2	0,1	0,112
	119	150	2	10	4,7	111	130	–	154	–	2	0,1	0,112
	120	148	2	17,7	17,7	111	130	–	154	–	2	0,09	0,125
	120	148	2	17,7	17,7	111	130	–	159	–	2	0,09	0,125
	118	157	2,1	10,1	–	112	130	150	168	0.9	2	0,108	0,11
	126	185	3	11.2	–	114	150	170	201	3,2	2,5	0,113	0,096
110	128	156	2	9,5	–	119	127	157	161	4	2	0,107	0,11
	126	150	2	12	6,6	119	130	–	161	–	2	0,107	0,103
	132	163	2	11,4	4,6	120	145	–	170	–	2	0,111	0,097
	132	176	2,1	11,1	–	122	150	165	188	1,9	2	0,113	0,103
120	138	166	2	10,6	–	129	145	160	171	0,9	2	0,111	0,109
	138	166	2	10,6	3,8	129	150	–	171	–	2	0,111	0,109
	140	164	2	12	5,2	129	150	–	171	–	2	0,109	0,103
	140	176	2	18	11,2	131	140	–	189	–	2	0,103	0,103
	144	191	2,1	13	–	132	143	192	203	5,4	2	0,113	0,103
	149	190	2,1	17,1	–	132	160	180	203	2,4	2	0,103	0,108
130	154	180	2	16,5	–	139	152	182	191	4,4	2	0,123	0,1
	149	181	2	11,4	–	139	155	175	191	1,9	2	0,113	0,097
	149	181	2	11,4	4,6	139	165	–	191	–	2	0,113	0,097
	153	190	2	9,7	9,7	141	170	–	199	–	2	0,09	0,126
	152	199	3	9,6	–	144	170	185	216	1,1	2,5	0,113	0,101
140	163	194	2	11	–	149	161	195	201	4,7	2	0,102	0,116
	161	193	2	11,4	5,9	149	175	–	201	–	2	0,115	0,097
	167	203	2,1	12	5,2	151	185	–	214	–	2	0,111	0,097
	173	223	3	13,7	–	154	190	210	236	2,3	2,5	0,109	0,108
150	173	204	2,1	2,8	–	161	172	200	214	1,3	2	–	0,108
	173	204	2,1	17,4	10,6	161	185	–	214	–	2	0,107	0,106
	182	226	2,1	13,9	–	162	195	215	238	2,3	2	0,12	0,092
	179	222	2,1	20	10,1	162	175	–	228	–	2	0,103	0,103
	177	236	3	11,2	–	164	200	215	256	2,5	2,5	0,119	0,096
160	187	218	2,1	15	–	171	186	220	229	5,1	2	0,115	0,106
	181	217	2,1	18,1	–	171	190	210	229	2,2	2	0,109	0,103
	181	217	2,1	18,1	8,2	171	195	–	229	–	2	0,109	0,103
	191	240	2,1	19	–	172	190	242	258	7,5	2	0,099	0,111
	190	241	2,1	21	11,1	172	190	–	258	–	2	0,101	0,105
	194	256	3	19,3	–	174	215	245	276	2,6	2,5	0,112	0,096

[1] Permissible axial displacement from normal position of one bearing ring in relation to the other (➔ **page 40**)
[2] To clear the cage for caged bearings or to clear the snap ring for full complement bearings
[3] To clear the cage for caged bearings
[4] Minimum width of free space for bearings with cage in normal position (➔ **page 18**)

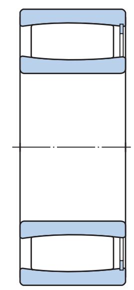
CARB toroidal roller bearings
d **170 – 340** mm



Cylindrical bore



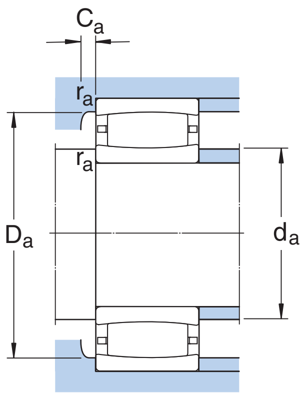
Tapered bore

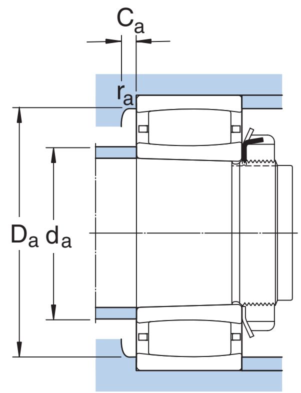


Full complement

Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designations Bearing with cylindrical bore	tapered bore
d	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
170	260	67	750	1 160	108	2 000	2 800	12,5	▶ **C 3034**	▶ **C 3034 K**
	260	90	1 140	1 860	170	–	480	17,5	▶ **C 4034 V**	**C 4034 K30V**
	280	88	1 040	1 460	137	1 900	2 600	21,0	▶ **C 3134**	▶ **C 3134 K**
	280	109	1 530	2 280	208	–	280	27,0	▶ **C 4134 V**	▶ **C 4134 K30V**
	310	86	1 270	1 630	150	2 000	2 600	28,0	**C 2234**	**C 2234 K**
180	280	74	880	1 340	125	1 900	2 600	16,5	**C 3036**	**C 3036 K**[1]
	280	100	1 320	2 120	193	–	430	23,0	**C 4036 V**	**C 4036 K30V**
	300	96	1 250	1 730	156	1 800	2 400	26,0	**C 3136**	**C 3136 K**[1]
	300	118	1 760	2 700	240	–	220	34,5	▶ **C 4136 V**	▶ **C 4136 K30V**
	320	112	1 530	2 200	196	1 500	2 000	37,0	**C 3236**	**C 3236 K**
190	290	75	930	1 460	132	1 800	2 400	17,5	**C 3038**	**C 3038 K**[1]
	290	100	1 370	2 320	204	–	380	24,5	▶ **C 4038 V**	▶ **C 4038 K30V**
	320	104	1 530	2 200	196	1 600	2 200	33,5	▶ **C 3138**	▶ **C 3138 K**
	320	128	2 040	3 150	275	–	130	43,0	▶ **C 4138 V**	▶ **C 4138 K30V**
	340	92	1 370	1 730	156	1 800	2 400	34,0	**C 2238**	**C 2238 K**[1]
200	310	82	1 120	1 730	153	1 700	2 400	22,0	**C 3040**	**C 3040 K**[1]
	310	109	1 630	2 650	232	–	260	30.5	▶ **C 4040 V**	▶ **C 4040 K30V**
	340	112	1 600	2 320	204	1 500	2 000	40,0	**C 3140**	**C 3140 K**[1]
	340	140	2 360	3 650	315	–	80	54,0	▶ **C 4140 V**	▶ **C 4140 K30V**
220	340	90	1 320	2 040	176	1 600	2 200	29,0	**C 3044**	**C 3044 K**[1]
	340	118	1 930	3 250	275	–	200	40,0	▶ **C 4044 V**	▶ **C 4044 K30V**
	370	120	1 900	2 900	245	1 400	1 900	51,0	**C 3144**	**C 3144 K**[1]
	400	108	2 000	2 500	216	1 500	2 000	56,5	**C 2244**	**C 2244 K**[1]
240	360	92	1 340	2 160	180	1 400	2 000	31,5	**C 3048**	**C 3048 K**[1]
	400	128	2 320	3 450	285	1 300	1 700	63,0	**C 3148**	**C 3148 K**[1]
260	400	104	1 760	2 850	232	1 300	1 800	46,0	**C 3052**	**C 3052 K**[1]
	440	144	2 650	4 050	325	1 100	1 500	87,0	**C 3152**	**C 3152 K**[1]
280	420	106	1 860	3 100	250	1 200	1 600	50,0	**C 3056**	**C 3056 K**[1]
	460	146	2 850	4 500	355	1 100	1 400	93,0	**C 3156**	**C 3156 K**[1]
300	460	118	2 160	3 750	290	1 100	1 500	71,0	**C 3060 M**	**C 3060 KM**
	460	160	2 900	4 900	380	850	1 200	95,0	**C 4060 M**	**C 4060 K30M**
	500	160	3 250	5 200	400	1 000	1 300	120	**C 3160**	**C 3160 K**[1]
320	480	121	2 280	4 000	310	1 000	1 400	76,5	**C 3064 M**	**C 3064 KM**
	540	176	4 150	6 300	480	950	1 300	160	**C 3164 M**	**C 3164 KM**
340	520	133	2 900	5 000	375	950	1 300	100	**C 3068 M**	**C 3068 KM**
	580	190	4 900	7 500	560	850	1 200	205	**C 3168 M**	**C 3168 KM**[1]

▶ Please check availability of the bearing before incorporating it in a bearing arrangement design
[1] Also aavailable in design K/HA3C4 or KM/HA3C4

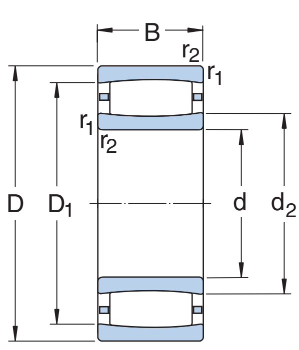




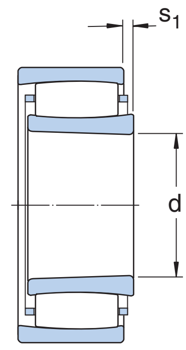
Dimensions						Abutment and fillet dimensions						Calculation factors	
d	d_2 ≈	D_1 ≈	$r_{1,2}$ min	s_1[1] ≈	s_2[1] ≈	d_a min	d_a[2] max	D_a[3] min	D_a max	C_a[4] min	r_a max	k_1	k_2
mm						mm						–	
170	200	237	2,1	12,5	–	181	200	238	249	5,8	2	0,105	0,112
	195	235	2,1	17,1	7,2	181	215	–	249	–	2	0,108	0,103
	200	249	2,1	21	–	182	200	250	268	7,6	2	0,101	0,109
	200	251	2,1	21	11,1	182	200	–	268	–	2	0,101	0,106
	209	274	4	16,4	–	187	230	255	293	3	3	0,114	0,1
180	209	251	2,1	15,1	–	191	220	240	269	2	2	0,112	0,105
	203	247	2,1	20,1	10,2	191	225	–	269	–	2	0,107	0,103
	210	266	3	23,2	–	194	230	255	286	2,2	2,5	0,102	0,111
	211	265	3	20	10,1	194	210	–	286	–	2,5	0,095	0,11
	228	289	4	27,3	–	197	245	275	303	3,2	3	0,107	0,104
190	225	266	2,1	16,1	–	201	235	255	279	1,9	2	0,113	0,107
	220	263	2,1	20	10,1	201	220	–	279	–	2	0,103	0,106
	228	289	3	19	–	204	227	290	306	9,1	2,5	0,096	0,113
	222	284	3	20	10,1	204	220	–	306	–	2,5	0,094	0,111
	224	296	4	22,5	–	207	250	275	323	1,6	3	0,108	0,108
200	235	285	2,1	15,2	–	211	250	275	299	2,9	2	0,123	0,095
	229	280	2,1	21	11,1	211	225	–	299	–	2	0,101	0,108
	245	305	3	27,3	–	214	260	307	326	–	2,5	0,108	0,104
	237	302	3	22	12,1	214	235	–	326	–	2,5	0,092	0,112
220	257	310	3	17,2	–	233	270	295	327	3,1	2,5	0,114	0,104
	251	306	3	20	10,1	233	250	–	327	–	2,5	0,095	0,113
	268	333	4	22,3	–	237	290	315	353	3,5	3	0,114	0,097
	259	350	4	20,5	–	237	295	320	383	1,7	3	0,113	0,101
240	276	329	3	19,2	–	253	290	315	347	1,3	2,5	0,113	0,106
	281	357	4	20,4	–	257	305	335	383	3,7	3	0,116	0,095
260	305	367	4	19,3	–	275	325	350	385	3,4	3	0,122	0,096
	314	394	4	26,4	–	277	340	375	423	4,1	3	0,115	0,096
280	328	389	4	21,3	–	295	350	375	405	1,8	3	0,121	0,098
	336	416	5	28,4	–	300	360	395	440	4,1	4	0,115	0,097
300	352	417	4	20	–	315	375	405	445	1,7	3	0,123	0,095
	338	409	4	30,4	–	315	360	400	445	2,8	3	0,105	0,106
	362	448	5	30,5	–	320	390	425	480	4,9	4	0,106	0,106
320	376	440	4	23,3	–	335	395	430	465	1,8	3	0,121	0,098
	372	476	5	26,7	–	340	410	455	520	3,9	4	0,114	0,096
340	402	482	5	25,4	–	358	430	465	502	1,9	4	0,12	0,099
	405	517	5	25,9	–	360	445	490	560	4,2	4	0,118	0,093

[1] Permissible axial displacement from normal position of one bearing ring in relation to the other (➔ **page 40**)
[2] To clear the cage for caged bearings or to clear the snap ring for full complement bearings
[3] To clear the cage for caged bearings
[4] Minimum width of free space for bearings with cage in normal position (➔ **page 18**)

CARB toroidal roller bearings
d **360 – 600** mm



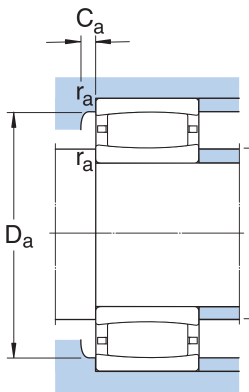
Cylindrical bore

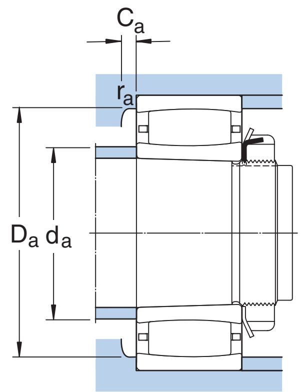


Tapered bore

Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designations Bearing with cylindrical bore	tapered bore
d	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
360	480	90	1 760	3 250	250	1 000	1 400	44,0	**C 3972 M**	**C 3972 KM**
	540	134	2 900	5 000	375	900	1 200	105	**C 3072 M**	**C 3072 KM**[1]
	600	192	5 000	8 000	585	800	1 100	215	**C 3172 M**	**C 3172 KM**[1]
380	520	106	2 120	4 000	300	950	1 300	65,5	▶ **C 3976 MB**	▶ **C 3976 KMB**
	560	135	3 000	5 200	390	900	1 200	110	**C 3076 M**	**C 3076 KM**
	620	194	4 550	7 500	540	750	1 000	230	▶ **C 3176 MB**	▶ **C 3176 KMB**
400	540	106	2 160	4 150	305	900	1 300	69,0	▶ **C 3980 MB**	▶ **C 3980 KMB**
	600	148	3 650	6 200	450	800	1 100	140	**C 3080 M**	**C 3080 KM**
	650	200	5 000	8 650	610	700	950	275	**C 3180 MB**	**C 3180 KMB**
420	560	106	2 160	4 250	310	850	1 200	71,0	**C 3984 M**	**C 3984 KM**
	620	150	3 800	6 400	465	800	1 100	150	**C 3084 M**	**C 3084 KM**
	700	224	6 000	10 400	710	670	900	340	**C 3184 M**	**C 3184 KM**[1]
440	600	118	2 750	5 300	375	800	1 100	98,0	▶ **C 3988 MB**	▶ **C 3988 KMB**
	650	157	3 750	6 400	465	750	1 000	185	**C 3088 MB**	**C 3088 KMB**
	720	226	5 700	9 300	655	670	900	360	▶ **C 3188 MB**	▶ **C 3188 KMB**
460	620	118	2 700	5 300	375	800	1 100	100	▶ **C 3992 MB**	▶ **C 3992 KMB**
	680	163	4 000	7 500	510	700	950	200	**C 3092 M**	**C 3092 KM**[1]
	760	240	6 800	12 000	800	600	800	430	**C 3192 M**	**C 3192 KM**
	760	300	8 300	14 300	950	480	630	535	**C 4192 M**	**C 4192 K30M**
480	650	128	3 100	6 100	430	750	1 000	120	**C 3996 M**	**C 3996 KM**
	700	165	4 050	7 800	530	670	900	210	**C 3096 M**	**C 3096 KM**
	790	248	6 950	12 500	830	560	750	490	▶ **C 3196 MB**	▶ **C 3196 KMB**
500	670	128	3 150	6 300	440	700	950	125	**C 39/500 M**	**C 39/500 KM**
	720	167	4 250	8 300	560	630	900	225	**C 30/500 M**	**C 30/500 KM**[1]
	830	264	7 500	12 700	850	530	750	550	**C 31/500 M**	**C 31/500 KM**[1]
	830	325	9 800	17 600	1 140	400	560	720	**C 41/500 MB**	**C 41/500 K30MB**
530	710	136	3 550	7 100	490	670	900	150	**C 39/530 M**	**C 39/530 KM**
	780	185	5 100	9 500	640	600	800	295	**C 30/530 M**	**C 30/530 KM**[1]
	870	272	8 800	15 600	1 000	500	670	630	**C 31/530 M**	**C 31/530 KM**[1]
560	750	140	3 600	7 350	490	600	850	170	**C 39/560 M**	**C 39/560 KM**
	820	195	5 600	11 000	720	530	750	345	**C 30/560 M**	**C 30/560 KM**[1]
	920	280	9 500	17 000	1 100	480	670	750	▶ **C 31/560 MB**	▶ **C 31/560 KMB**
600	800	150	4 000	8 800	570	560	750	210	**C 39/600 M**	**C 39/600 KM**
	870	200	6 300	12 200	780	500	700	390	**C 30/600 M**	**C 30/600 KM**[1]
	980	300	10 200	18 000	1120	430	600	870	▶ **C 31/600 MB**	**C 31/600 KMB**

▶ Please check availability of the bearing before incorporating it in a bearing arrangement design
[1] Also available in design K/HA3C4 or KM/HA3C4

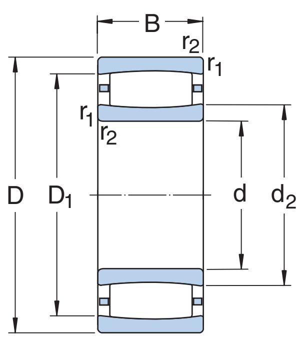




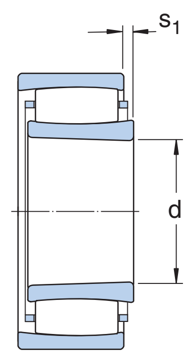
Dimensions					Abutment and fillet dimensions						Calculation factors	
d	d_2 ≈	D_1 ≈	$r_{1,2}$ min	s_1[1] ≈	d_a min	d_a[2] max	D_a[2] min	D_a max	C_a[3] min	r_a max	k_1	k_2
mm					mm						–	
360	394	450	3	17,2	373	405	440	467	1,6	2,5	0,127	0,104
	417	497	5	26,4	378	445	480	522	2	4	0,12	0,099
	423	537	5	27,9	380	460	510	522	3,9	4	0,117	0,094
380	429	489	4	10	395	425	490	505	9,7	3	–	0,128
	431	511	5	27	398	460	495	542	2	4	0,12	0,1
	450	550	5	19	400	445	445	600	16,4	4	–	0,106
400	440	500	4	10	415	435	505	525	9,7	3	–	0,128
	458	553	5	30,6	418	480	525	582	2,1	4	0,121	0,099
	485	589	6	10,1	426	480	565	624	4,4	5	–	0,109
420	462	522	4	21,3	435	480	515	545	1,8	3	0,132	0,098
	475	570	5	32,6	438	510	550	602	2,2	4	0,12	0,1
	508	618	6	34,8	446	540	595	674	3,8	5	0,113	0,098
440	495	564	4	11	455	490	565	585	10,5	3	–	0,119
	491	587	6	19,7	463	490	565	627	1,7	5	–	0,105
	514	633	6	22	466	510	635	694	19,1	5	–	0,102
460	508	577	4	11	475	505	580	605	10,4	3	–	0,12
	539	624	6	33,5	486	565	605	654	2,3	5	0,114	0,108
	559	679	7,5	51	492	570	655	728	4,2	6	0,108	0,105
	540	670	7,5	46,2	492	570	655	728	5,6	6	0,111	0,097
480	529	604	5	20,4	498	550	590	632	2	4	0,133	0,095
	555	640	6	35,5	503	580	625	677	2,3	5	0,113	0,11
	583	700	7,5	24	512	580	705	758	20,6	6	–	0,104
500	556	631	5	20,4	518	580	615	652	2	4	0,135	0,095
	572	656	6	37,5	523	600	640	697	2,3	5	0,113	0,111
	605	738	7,5	75,3	532	655	705	798	–	6	0,099	0,116
	598	740	7,5	16,3	532	595	705	798	5,9	6	–	0,093
530	578	657	5	28,4	548	600	640	692	2,2	4	0,129	0,101
	601	704	6	35,7	553	635	685	757	2,5	5	0,12	0,101
	635	781	7,5	44,4	562	680	745	838	4,8	6	0,115	0,097
560	622	701	5	32,4	578	645	685	732	2,3	4	0,128	0,104
	660	761	6	45,7	583	695	740	793	2,7	5	0,116	0,106
	664	808	7,5	28	592	660	810	888	23,8	6	–	0,111
600	666	744	5	32,4	618	685	725	782	2,4	4	0,131	0,1
	692	805	6	35,9	623	725	775	847	2,7	5	0,125	0,098
	710	870	7,5	30	632	705	875	948	25,4	6	–	0,105

[1] Permissible axial displacement from normal position of one bearing ring in relation to the other (➔ **page 40**)
[2] To clear the cage
[3] Minimum width of free space for bearings with cage in normal position (➔ **page 18**)

CARB toroidal roller bearings
d **630 – 1 250** mm



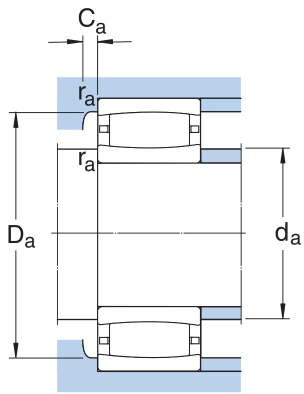
Cylindrical bore

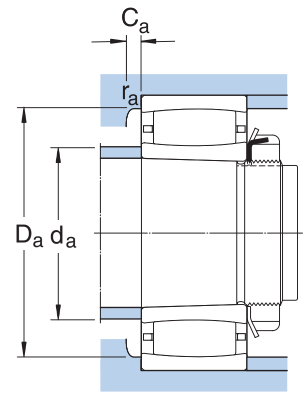


Tapered bore

Principal dimensions			**Basic load ratings** dynamic	static	**Fatigue load limit**	**Speed ratings** Reference speed	Limiting speed	**Mass**	**Designations** Bearing with cylindrical bore	tapered bore
d	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
630	850	165	4 650	10 000	640	530	700	270	**C 39/630 M**	**C 39/630 KM**
	920	212	6 800	12 900	830	480	670	465	**C 30/630 M**	**C 30/630 KM**[1]
	1 030	315	12 200	22 000	1 370	400	560	1 040	▶ **C 31/630 MB**	▶ **C 31/630 KMB**
670	900	170	4 900	11 200	695	480	630	310	**C 39/670 M**	**C 39/670 KM**
	980	230	8 150	16 300	1 000	430	600	580	**C 30/670 M**	**C 30/670 KM**[1]
	1 090	336	12 000	22 000	1 320	380	530	1 230	▶ **C 31/670 MB**	▶ **C 31/670 KMB**
710	950	180	6 000	12 500	780	450	630	355	**C 39/710 M**	**C 39/710 KM**
	1 030	236	8 800	17 300	1 060	400	560	645	**C 30/710 M**	**C 30/710 KM**
	1 030	315	10 600	21 600	1 290	320	430	860	**C 40/710 M**	**C 40/710 K30M**
	1 150	345	12 700	24 000	1 430	360	480	1 410	▶ **C 31/710 MB**	▶ **C 31/710 KMB**
750	1 000	185	6 100	13 400	815	430	560	405	**C 39/750 M**	**C 39/750 KM**
	1 090	250	9 000	18 000	1 100	380	530	770	▶ **C 30/750 MB**	▶ **C 30/750 KMB**
	1 220	365	16 000	30 500	1 800	320	450	1 700	▶ **C 31/750 MB**	▶ **C 31/750 KMB**
800	1 060	195	6 400	14 600	865	380	530	470	**C 39/800 M**	**C 39/800 KM**
	1 150	258	9 150	18 600	1 120	360	480	860	▶ **C 30/800 MB**	▶ **C 30/800 KMB**
	1 280	375	15 600	30 500	1 760	300	400	1 870	▶ **C 31/800 MB**	▶ **C 31/800 KMB**
850	1 120	200	7 350	16 300	965	360	480	530	**C 39/850 M**	**C 39/850 KM**
	1 220	272	11 200	24 000	1 370	320	430	1 050	▶ **C 30/850 MB**	▶ **C 30/850 KMB**
	1 360	400	16 000	32 000	1 830	280	380	2 260	▶ **C 31/850 MB**	▶ **C 31/850 KMB**
900	1 180	206	8 150	18 000	1 060	340	450	580	▶ **C 39/900 MB**	▶ **C 39/900 KMB**
	1 280	280	12 700	26 500	1 530	300	400	1 150	**C 30/900 M**	**C 30/900 KM**
950	1 250	224	9 300	22 000	1 250	300	430	745	**C 39/950 M**	**C 39/950 KM**
	1 360	300	12 900	27 500	1 560	280	380	1 410	▶ **C 30/950 MB**	▶ **C 30/950 KMB**
1 000	1 420	308	13 400	29 000	1 630	260	340	1 570	▶ **C 30/1000 MB**	▶ **C 30/1000 KMB**
	1 580	462	22 800	45 500	2 500	220	300	3 470	▶ **C 31/1000 MB**	▶ **C 31/1000 KMB**
1 060	1 400	250	12 500	29 000	1 600	260	340	1 040	▶ **C 39/1060 MB**	▶ **C 39/1060 KMB**
1 180	1 540	272	12 900	31 500	1 660	220	300	1 340	**C 39/1180 M**	**C 39/1180 KM**
1 250	1 750	375	20 400	45 000	2 320	180	240	2 740	▶ **C 30/1250 MB**	▶ **C 30/1250 KMB**

▶ Please check availability of the bearing before incorporating it in a bearing arrangement design
[1] Also available in design K/HA3C4 or KM/HA3C4

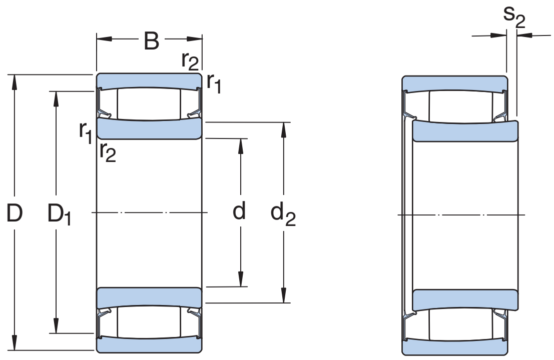




Dimensions					**Abutment and fillet dimensions**						**Calculation factors**	
d	d_2 ≈	D_1 ≈	$r_{1,2}$ min	s_1[1] ≈	d_a min	d_a[2] max	D_a[2] min	D_a max	C_a[3] min	r_a max	k_1	k_2
mm					mm						–	
630	700	784	6	35,5	653	720	770	827	2,4	5	0,121	0,11
	717	840	7,5	48,1	658	755	810	892	2,9	6	0,118	0,104
	749	919	7,5	31	662	745	920	998	26,8	6	–	0,109
670	764	848	6	40,5	693	765	830	877	2,5	5	0,121	0,113
	775	904	7,5	41,1	698	820	875	952	2,9	6	0,121	0,101
	797	963	7,5	33	702	795	965	1 058	28	6	–	0,104
710	773	877	6	30,7	733	795	850	927	2,7	5	0,131	0,098
	807	945	7,5	47,3	738	850	910	1 002	3,2	6	0,119	0,104
	803	935	7,5	51,2	738	840	915	1 002	4,4	6	0,113	0,101
	848	1 012	9,5	34	750	845	1 015	1 100	28,6	8	–	0,102
750	830	933	6	35,7	773	855	910	977	2,7	5	0,131	0,101
	858	993	7,5	25	778	855	995	1 062	21,8	6	–	0,112
	888	1 076	9,5	36	790	885	1 080	1 180	31,5	8	–	0,117
800	889	990	6	45,7	823	915	970	1 037	2,9	5	0,126	0,106
	913	1 047	7,5	25	828	910	1 050	1 122	22,3	6	–	0,111
	947	1 133	9,5	37	840	945	1 135	1 240	32,1	8	–	0,115
850	940	1 053	6	35,9	873	960	1 025	1 097	2,9	5	0,135	0,098
	968	1 113	7,5	27	878	965	1 115	1 192	24,1	6	–	0,124
	1 020	1 200	12	40	898	1 015	1 205	1 312	33,5	10	–	0,11
900	989	1 113	6	20	923	985	1 115	1 157	18,4	5	–	0,132
	1 008	1 172	7,5	45,8	928	1 050	1 130	1 252	3,4	6	0,124	0,1
950	1 044	1 167	7,5	35	978	1 080	1 145	1 222	3,1	6	0,134	0,098
	1 080	1 240	7,5	30	978	1 075	1 245	1 322	26,2	6	–	0,116
1 000	1 136	1 294	7,5	30	1 028	1 135	1 295	1 392	26,7	6	–	0,114
	1 179	1 401	12	46	1 048	1 175	1 405	1 532	38,6	10	–	0,105
1 060	1 175	1 323	7,5	25	1 088	1 170	1 325	1 372	23,4	6	–	0,142
1 180	1311	1457	7,5	44,4	1 208	1 335	1 425	1 512	4,1	6	0,137	0,097
1 250	1 397	1 613	9,5	37	1 284	1 395	1 615	1 716	33,9	8	–	0,126

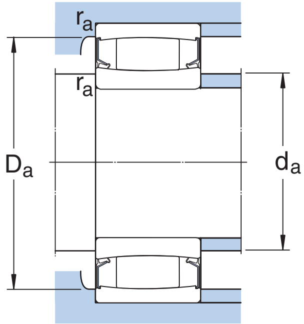
[1] Permissible axial displacement from normal position of one bearing ring in relation to the other (➔ **page 40**)
[2] To clear the cage
[3] Minimum width of free space for bearings with cage in normal position (➔ **page 18**)

SealedCARB toroidal roller bearings
d **50 – 200** mm



Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed rating Limiting speed	Mass	Designation
d	D	B	C	C_0	P_u			
mm			kN		kN	r/min	kg	–
50	72	40	140	224	24,5	200	0,56	▶ **C 6910-2CS5V**
60	85	45	150	240	26,5	170	0,83	▶ **C 6912-2CS5V**
	85	45	190	335	36	–	0,85	**C 6912-2NSV**
65	100	35	102	173	19	150	1,10	**C 4013-2CS5V**
75	105	54	204	325	37,5	140	1,40	**C 6915-2CS5V**
	115	40	143	193	23,2	130	1,40	▶ **C 4015-2CS5V**
90	125	46	224	400	44	110	1,75	**C 5918-2CS5V**
100	150	50	310	450	50	95	2,90	▶ **C 4020-2CS5V**
	165	65	475	655	69,5	90	5,20	**C 4120-2CS5V**
110	170	60	415	585	63	85	4,60	**C 4022-2CS5V**
	180	69	500	710	75	85	6,60	**C 4122-2CS5V**
120	180	60	430	640	67	80	5,10	**C 4024-2CS5V**
	200	80	710	1 000	100	75	9,70	▶ **C 4124-2CS5V**
130	200	69	550	830	85	70	7,50	**C 4026-2CS5V**
	210	80	750	1 100	108	70	10,5	**C 4126-2CS5V**
140	210	69	570	900	88	67	7,90	▶ **C 4028-2CS5V**
	225	85	780	1 200	116	63	12,5	**C 4128-2CS5V**
150	225	75	585	965	93	63	10,0	**C 4030-2CS5V**
	250	100	1 220	1 860	173	60	20,5	▶ **C 4130-2CS5V**
160	240	80	655	1 100	104	60	12,0	▶ **C 4032-2CS5V**
	270	109	1 460	2 160	200	53	26,0	▶ **C 4132-2CS5V**
170	260	90	965	1 630	150	53	17,0	▶ **C 4034-2CS5V**
	280	109	1 530	2 280	208	53	27,0	▶ **C 4134-2CS5V**
180	280	100	1 320	2 120	193	53	23,5	▶ **C 4036-2CS5V**
	300	118	1 760	2 700	240	48	35,0	▶ **C 4136-2CS5V**
190	290	100	1 370	2 320	204	48	24,5	▶ **C 4038-2CS5V**
	320	128	2 040	3 150	275	45	43,5	▶ **C 4138-2CS5V**
200	310	109	1 630	2 650	232	45	31,0	▶ **C 4040-2CS5V**
	340	140	2 360	3 650	315	43	54,5	▶ **C 4140-2CS5V**

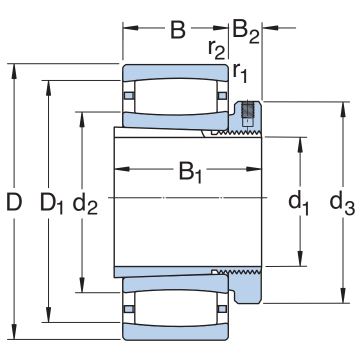
▶ Please check availability of the bearing before incorporating it in a bearing arrangement design



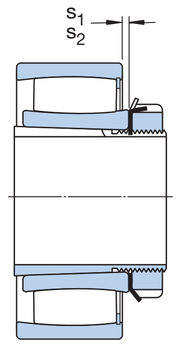
Dimensions					Abutment and fillet dimensions				Calculation factors	
d	d_2 ≈	D_1 ≈	$r_{1,2}$ min	s_2[1] ≈	d_a min	d_a[2] max	D_a max	r_a max	k_1	k_2
mm					mm				–	
50	57,6	64,9	0,6	2,8	53,2	57	68,8	0,6	0,113	0,091
60	68	75,3	1	5,4	64,6	67	80,4	1	0,128	0,083
	68	77,5	1	0,5	64,6	67	80,4	1	0,108	0,096
65	78,6	87,5	1,1	5,9	71	78	94	1	0,071	0,181
75	83,6	95,5	1	7,1	79,6	83	100	1	0,073	0,154
	88,5	104	1,1	7,3	81	88	111	1	0,210	0,063
90	102	113	1,1	4,5	96	101	119	1	0,089	0,131
100	114	136	1,5	6,2	107	113	143	1,5	0,145	0,083
	120	148	2	7,3	111	119	154	2	0,09	0,125
110	128	155	2	7,9	119	127	161	2	0,142	0,083
	130	160	2	8,2	121	129	169	2	0,086	0,133
120	140	164	2	7,5	129	139	171	2	0,085	0,142
	140	176	2	8,2	131	139	189	2	0,126	0,087
130	152	182	2	8,2	139	151	191	2	0,089	0,133
	153	190	2	7,5	141	152	199	2	0,09	0,126
140	163	193	2	8,7	149	162	201	2	0,133	0,089
	167	204	2,1	8,9	152	166	213	2	0,086	0,134
150	175	204	2,1	10,8	161	174	214	2	0,084	0,144
	179	221	2,1	6,4	162	178	238	2	0,103	0,103
160	188	218	2,1	11,4	170	187	230	2	0,154	0,079
	190	241	2,1	6,7	172	189	258	2	0,101	0,105
170	201	237	2,1	9	180	199	250	2	0,116	0.097
	200	251	2,1	6,7	182	198	268	2	0,101	0,106
180	204	246	2,1	6,4	190	202	270	2	0,103	0,105
	211	265	3	6,4	194	209	286	2,5	0,095	0,11
190	221	263	2,1	6,4	200	219	280	2	0,103	0,106
	222	283	3	6,4	204	220	306	2,5	0,094	0,111
200	229	280	2,1	6,7	210	227	300	2	0,101	0,108
	237	301	3	7	214	235	326	2,5	0,092	0,112

[1] Permissible axial displacement from normal position of one bearing ring in relation to the other (➔ **page 40**)
[2] To clear the seal

CARB toroidal roller bearings on adapter sleeve
d_1 **20 – 80** mm



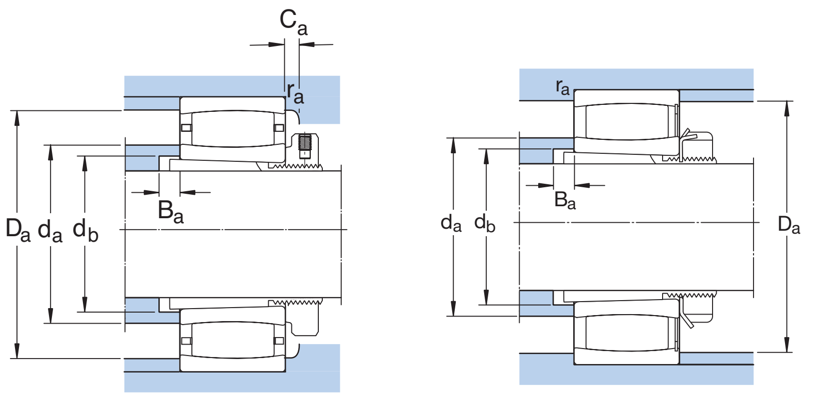
CARB on sleeve H .. E



CARB on sleeve H

Principal dimensions d_1	D	B	**Basic load ratings** dynamic C	static C_0	**Fatigue load limit** P_u	**Speed ratings** Reference speed	Limiting speed	**Mass** Bearing + sleeve	**Designations** Bearing	Adapter sleeve
mm			kN		kN	r/min		kg	–	
20	52	18	44	40	4,55	13 000	18 000	0,24	▶ **C 2205 KTN9**	**H 305 E**
	52	18	50	48	5,5	–	7 000	0,25	▶ **C 2205 KV**	**H 305 E**
25	62	20	69,5	62	7,2	11 000	15 000	0,37	**C 2206 KTN9**	**H 306 E**
	62	20	76,5	71	8,3	–	6 000	0,39	**C 2206 KV**	**H 306 E**
30	72	23	83	80	9, 3	9 500	13 000	0,59	**C 2207 KTN9**	**H 307 E**
	72	23	95	96,5	11,2	–	5 000	0,59	**C 2207 KV**	**H 307 E**
35	80	23	90	86,5	10,2	8 000	11 000	0,69	**C 2208 KTN9**	**H 308 E**
	80	23	102	104	12	–	4 500	0,70	**C 2208 KV**	**H 308**
40	85	23	93	93	10,8	8 000	11 000	0,76	**C 2209 KTN9**	**H 309 E**
	85	23	106	110	12,9	–	4 300	0,79	**C 2209 KV**	**H 309 E**
45	90	23	98	100	11,8	7 000	9 500	0,85	**C 2210 KTN9**	**H 310 E**
	90	23	114	122	14,3	–	3 800	0,89	**C 2210 KV**	**H 310 E**
50	100	25	116	114	13,4	6 700	9 000	1,10	**C 2211 KTN9**	**H 311 E**
	100	25	132	134	16	–	3 400	1,15	**C 2211 KV**	**H 311 E**
55	110	28	143	156	18,3	5 600	7 500	1,45	**C 2212 KTN9**	**H 312 E**
	110	28	166	190	22,4	–	2 800	1,50	**C 2212 KV**	**H 312**
60	120	31	180	180	21,2	5 300	7 500	1,80	**C 2213 KTN9**	**H 313 E**
	120	31	204	216	25,5	–	2 400	1,90	**C 2213 KV**	**H 313**
	125	31	186	196	23,2	5 000	7 000	2,10	**C 2214 KTN9**	**H 314 E**
	125	31	212	228	27	–	2 400	2,20	**C 2214 KV**	**H 314**
	150	51	405	430	49	3 800	5 000	5,10	**C 2314 K**	**H 2314**
65	130	31	196	208	25,5	4 800	6 700	2,30	**C 2215 K**	**H 315 E**
	130	31	220	240	29	–	2 200	2,40	**C 2215 KV**	**H 315**
	160	55	425	465	52	3 600	4 800	6,20	**C 2315 K**	**H 2315**
70	140	33	220	250	28,5	4 500	6 000	2,90	**C 2216 K**	**H 316 E**
	140	33	255	305	34,5	–	2 000	3,00	**C 2216 KV**	**H 316**
	170	58	510	550	61	3 400	4 500	7,40	**C 2316 K**	**H 2316**
75	150	36	275	320	36,5	4 300	5 600	3,70	**C 2217 K**	**H 317 E**
	150	36	315	390	44	–	1 800	3,85	**C 2217 KV**	**H 317**
	180	60	540	600	65,5	3 200	4 300	8,50	**C 2317 K**	**H 2317**
80	160	40	325	380	42,5	3 800	5 300	4,50	**C 2218 K**	**H 318 E**
	160	40	365	440	49	–	1 500	4,60	**C 2218 KV**	**H 318**
	190	64	610	695	73,5	2 800	4 000	10,0	**C 2318 K**	**H 2318**

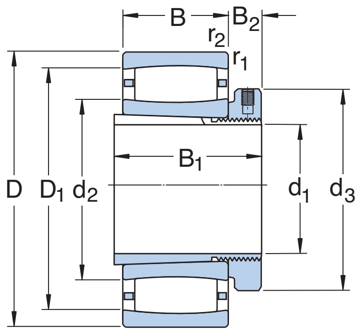
▶ Please check availability of the bearing before incorporating it in a bearing arrangement design



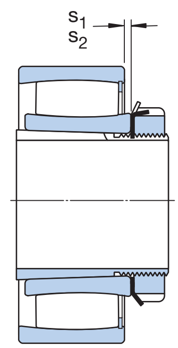
Dimensions									Abutment and fillet dimensions							Calculation factors	
d_1	d_2 ≈	d_3	D_1 ≈	B_1	B_2	$r_{1,2}$ min	s_1[1] ≈	s_2[1] ≈	d_a[2] max	d_b min	D_a min	D_a max	B_a min	C_a[3] min	r_a max	k_1	k_2
mm									mm							–	
20	32,1	38	43,3	29	10,5	1	5,8	–	32	28	42	46,4	5	0,3	1	0,09	0,126
	32,1	38	43,3	29	10,5	1	5,8	2,8	39	28	–	46,4	5	–	1	0,09	0,126
25	37,4	45	53,1	31	10,5	1	4,5	–	37	33	51	56,4	5	0,3	1	0,101	0,111
	37,4	45	53,1	31	10,5	1	4,5	1,5	49	33	–	56,4	5	–	1	0,101	0,111
30	44,8	52	60,7	35	11,5	1,1	5,7	–	44	39	59	65	5	0,1	1	0,094	0,121
	44,8	52	60,7	35	11,5	1,1	5,7	2,7	57	39	–	65	5	–	1	0,094	0,121
35	52,4	58	69,9	36	13	1,1	7,1	–	52	44	68	73	5	0,3	1	0,093	0,128
	52,4	58	69,9	36	10	1,1	7,1	4,1	66	44	–	73	5	–	1	0,093	0,128
40	55,6	65	73,1	39	13	1,1	7,1	–	55	50	71	78	7	0,3	1	0,095	0,128
	55,6	65	73,1	39	13	1,1	7,1	4,1	69	50	–	78	7	–	1	0,095	0,128
45	61,9	70	79,4	42	14	1,1	7,1	–	61	55	77	83	9	0,8	1	0,097	0,128
	61,9	70	79,4	42	14	1,1	7,1	3,9	73	55	–	83	9	–	1	0,097	0,128
50	65,8	75	86,7	45	14	1,5	8,6	–	65	60	84	91	10	0,3	1,5	0,094	0,133
	65,8	75	86,7	45	14	1,5	8,6	5,4	80	60	–	91	10	–	1,5	0,094	0,133
55	77,1	80	97,9	47	14	1,5	8,5	–	77	65	95	101	9	0,3	1,5	0,1	0,123
	77,1	80	97,9	47	13	1,5	8,5	5,3	91	65	–	101	9	–	1,5	0,1	0,123
60	79	85	106	50	15	1,5	9,6	–	79	70	102	111	8	0,2	1,5	0,097	0,127
	79	85	106	50	14	1,5	9,6	5,3	97	70	–	111	8	–	1,5	0,097	0,127
	83,7	92	111	52	15	1,5	9,6	–	83	75	107	116	9	0,4	1,5	0.098	0,127
	83,7	92	111	52	14	1,5	9,6	5,3	102	75	–	116	9	–	1,5	0,098	0,127
	91,4	92	130	68	14	2,1	9,1	–	105	76	120	138	6	2,2	2	0,11	0,099
65	88,5	98	115	55	16	1,5	9,6	–	98	80	110	121	12	1,2	1,5	0,099	0,127
	88,5	98	115	55	15	1,5	9,6	5,3	105	80	–	121	12	–	1,5	0,099	0,127
	98,5	98	135	73	15	2,1	13,1	–	110	82	130	148	5	2,2	2	0,103	0,107
70	98,1	105	125	59	18	2	9,1	–	105	85	120	129	12	1,2	2	0,104	0,121
	98,1	105	125	59	17	2	9,1	4,8	115	85	–	129	12	–	2	0,104	0,121
	102	105	145	78	17	2,1	10,1	–	115	88	135	158	6	2,4	2	0,107	0,101
75	104	110	133	63	19	2	7,1	–	110	91	125	139	12	1,3	2	0,114	0,105
	104	110	133	63	18	2	7,1	1,7	115	91	–	139	12	–	2	0,114	0,105
	110	110	153	82	18	3	12,1	–	125	94	145	166	7	2,4	2,5	0,105	0,105
80	112	120	144	65	19	2	9,5	–	120	96	130	149	10	1,4	2	0,104	0,117
	112	120	144	65	18	2	9,5	5,4	125	96	–	149	10	–	2	0,104	0,117
	119	120	166	86	18	3	9,6	–	135	100	155	176	7	2	2,5	0,108	0,101

[1] Permissible axial displacement from normal position of one bearing ring in relation to the other (→ **page 40**)
[2] To clear the cage for caged bearings or to clear the snap ring for full complement bearings
[3] Minimum width of free space for bearings with cage in normal position (→ **page 18**)

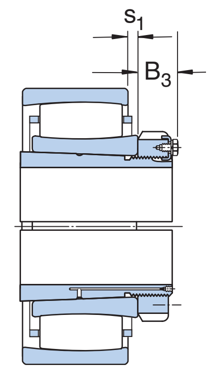
CARB toroidal roller bearings on adapter sleeve
d_1 **85 – 180** mm



CARB on sleeve H .. (E)



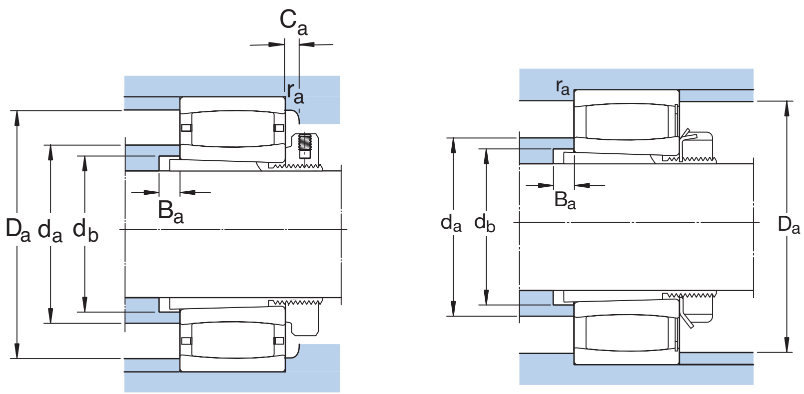
CARB on sleeve H .. (L)



CARB on sleeve OH .. H(TL)

Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass Bearing + sleeve	Designations Bearing	Adapter sleeve
d_1	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
85	170	43	360	400	44	3 800	5 000	5,30	▶ **C 2219 K**	**H 319 E**
	200	67	610	695	73,5	2 800	4 000	11,5	**C 2319 K**	**H 2319**
90	165	52	415	540	58,5	3 200	4 300	6,10	▶ **C 3120 K**	**H 3120 E**
	165	52	475	655	69,5	–	1 300	6,10	**C 3120 KV**	**H 3120 E**
	180	46	415	465	47,5	3 600	4 800	6,30	**C 2220 K**	**H 320 E**
	215	73	800	880	91,5	2 600	3 600	14,5	**C 2320 K**	**H 2320**
100	170	45	355	480	51	3 200	4 500	5,50	**C 3022 K**	**H 322 E**
	200	53	530	620	64	3 200	4 300	8,80	**C 2222 K**	**H 322 E**
110	180	46	375	530	55	3 000	4 000	5,70	**C 3024 K**	**H 3024 E**
	180	46	430	640	67	–	1 400	5,85	**C 3024 KV**	**H 3024**
	215	58	610	710	72	3 000	4 000	8,60	▶ **C 2224 K**	**H 3124 L**
	215	76	750	980	98	2 400	3 200	14,2	**C 3224 K**	**H 2324 L**
115	200	52	390	585	58,5	2 800	3 800	8,70	▶ **C 3026 K**	**H 3026**
	230	64	735	930	93	2 800	3 800	14,0	**C 2226 K**	**H 3126 L**
125	210	53	490	735	72	2 600	3 400	9,30	▶ **C 3028 K**	**H 3028**
	250	68	830	1 060	102	2 400	3 400	17,5	**C 2228 K**	**H 3128 L**
135	225	56	600	980	93	2 400	3 200	12,0	**C 3030 KMB**	**H 3030 E**
	250	80	880	1 290	122	2 000	2 800	20,0	**C 3130 K**	**H 3130 L**
	270	73	980	1 220	116	2 400	3 200	23,0	**C 2230 K**	**H 3130 L**
140	240	60	600	980	93	2 200	3 000	14,5	▶ **C 3032 K**	**H 3032**
	270	86	1 000	1 400	132	2 000	2 600	27,0	▶ **C 3132 K**	**H 3132 L**
	290	104	1 370	1 830	170	1 700	2 400	36,5	**C 3232 K**	**H 2332 L**
150	260	67	750	1 160	108	2 000	2 800	18,0	▶ **C 3034 K**	**H 3034**
	280	88	1 040	1 460	137	1 900	2 600	29,0	▶ **C 3134 K**	**H 3134 L**
	310	86	1 270	1 630	150	2 000	2 600	35,0	**C 2234 K**	**H 3134 L**
160	280	74	880	1 340	125	1 900	2 600	23,0	**C 3036 K**	**H 3036**
	300	96	1 250	1 730	156	1 800	2 400	34,0	**C 3136 K**	**H 3136 L**
	320	112	1 530	2 200	196	1 500	2 000	47,0	**C 3236 K**	**H 2336**
170	290	75	930	1 460	132	1 800	2 400	24,0	**C 3038 K**	**H 3038**
	320	104	1 530	2 200	196	1 600	2 200	44,0	▶ **C 3138 K**	**H 3138 L**
	340	92	1 370	1 730	156	1 800	2 400	43,0	**C 2238 K**	**H 3138**
180	310	82	1 120	1 730	153	1 700	2 400	30,0	**C 3040 K**	**H 3040**
	340	112	1 600	2 320	204	1 500	2 000	50,5	**C 3140 K**	**H 3140**

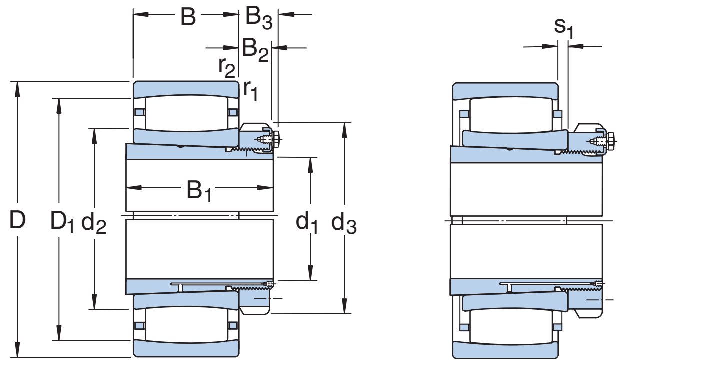
▶ Please check availability of the bearing before incorporating it in a bearing arrangement design



Dimensions									Abutment and fillet dimensions							Calculation factors	
d_1	d_2 ≈	d_3	D_1 ≈	B_1	B_2	$r_{1,2}$ min	s_1[1] ≈	s_2[1] ≈	d_a[2] max	d_b min	D_a min	D_a max	B_a min	C_a[3] min	r_a max	k_1	k_2
mm									mm							–	
85	113	125	149	68	20	2,1	10,5	–	112	102	149	158	9	4,2	2	0,114	0,104
	120	125	166	90	19	3	12,6	–	135	105	155	186	7	2,1	2,5	0,103	0,106
90	119	130	150	76	21	2	10	–	119	106	150	154	6	4,5	2	0,1	0,112
	119	130	150	76	20	2	10	4,7	130	106	–	154	6	–	2	0,1	0,112
	118	130	157	71	21	2,1	10,1	–	130	108	150	168	8	0.9	2	0,108	0,11
	126	130	185	97	20	3	11.2	–	150	110	170	201	7	3,2	2,5	0,113	0,096
100	128	145	156	77	21,5	2	9,5	–	127	118	157	160	14	4	2	0,107	0,11
	132	145	176	77	21,5	2,1	11,1	–	150	118	165	188	6	1,9	2	0,113	0,103
110	138	155	166	72	26	2	10,6	–	145	127	160	170	7	0,9	2	0,111	0,109
	138	145	166	72	22	2	10,6	3,8	150	127	–	170	7	–	2	0,111	0,109
	144	145	191	88	22	2,1	13	–	143	128	192	203	11	5,4	2	0,113	0,103
	149	145	190	112	22	2,1	17,1	–	160	131	180	203	17	2,4	2	0,103	0,108
115	154	155	180	80	23	2	16,5	–	152	137	182	190	8	4,4	2	0,123	0,1
	152	155	199	92	23	3	9,6	–	170	138	185	216	8	1,1	2,5	0,113	0,101
125	163	165	194	82	24	2	11	–	161	147	195	200	8	4,7	2	0,102	0,116
	173	165	223	97	24	3	13,7	–	190	149	210	236	8	2,3	2,5	0,109	0,108
135	173	180	204	87	26	2,1	2,8	–	172	158	200	214	8	1,3	2	–	0,108
	182	180	226	111	26	2,1	13,9	–	195	160	215	238	8	2,3	2	0,12	0,092
	177	180	236	111	26	3	11,2	–	200	160	215	256	15	2,5	2,5	0,119	0,096
140	187	190	218	93	27,5	2,1	15	–	186	168	220	229	8	5,1	2	0,115	0,106
	191	190	240	119	27,5	2,1	19	–	190	170	242	258	8	7,5	2	0,099	0,111
	194	190	256	147	27,5	3	19,3	–	215	174	245	276	18	2,6	2,5	0,112	0,096
150	200	200	237	101	28,5	–	2,1	12,5	200	179	238	249	8	5,8	2	0,105	0,112
	200	200	249	122	28,5	–	2,1	21	200	180	250	268	8	7,6	2	0,101	0,109
	209	200	274	122	28,5	–	4	16,4	230	180	255	293	10	3	3	0,114	0,1
160	209	210	251	109	29,5	–	2,1	15,1	220	189	240	269	8	2	2	0,112	0,105
	210	210	266	131	29,5	–	3	23,2	230	191	255	286	8	2,2	2,5	0,102	0,111
	228	230	289	161	30	–	4	27,3	245	195	275	303	22	3,2	3	0,107	0,104
170	225	220	266	112	30,5	–	2,1	16,1	235	199	255	279	9	1,9	2	0,113	0,107
	228	220	289	141	30,5	–	3	19	227	202	290	306	9	9,1	2,5	0,096	0,113
	224	240	296	141	31	–	4	22,5	250	202	275	323	21	1,6	3	0,108	0,108
180	235	240	285	120	31,5	–	2,1	15,2	250	210	275	299	9	2,9	2	0,123	0,095
	245	250	305	150	32	–	3	27,3	260	212	307	326	9	–	2,5	0,108	0,104

[1] Permissible axial displacement from normal position of one bearing ring in relation to the other (➔ **page 40**)
[2] To clear the cage for caged bearings or to clear the snap ring for full complement bearings
[3] Minimum width of free space for bearings with cage in normal position (➔ **page 18**)

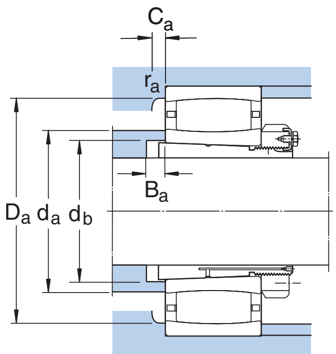
CARB toroidal roller bearings on adapter sleeve
d_1 **200 – 430** mm



CARB on sleeve OH .. H(TL)   CARB on sleeve OH .. HE

Principal dimensions d_1	D	B	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Speed ratings Reference speed	Limiting speed	Mass Bearing + sleeve	Designations Bearing	Adapter sleeve
mm			kN		kN	r/min		kg	–	
200	340	90	1 320	2 040	176	1 600	2 200	37,0	**C 3044 K**	**OH 3044 H**
	370	120	1 900	2 900	245	1 400	1 900	64,0	**C 3144 K**	**OH 3144 HTL**
	400	108	2 000	2 500	216	1 500	2 000	69,0	**C 2244 K**	**OH 3144 H**
220	360	92	1 340	2 160	180	1 400	2 000	42,5	**C 3048 K**	**OH 3048 H**
	400	128	2 320	3 450	285	1 300	1 700	77,0	**C 3148 K**	**OH 3148 HTL**
240	400	104	1 760	2 850	232	1 300	1 800	59,0	**C 3052 K**	**OH 3052 H**
	440	144	2 650	4 050	325	1 100	1 500	105	**C 3152 K**	**OH 3152 HTL**
260	420	106	1 860	3 100	250	1 200	1 600	65,0	**C 3056 K**	**OH 3056 H**
	460	146	2 850	4 500	355	1 100	1 400	115	**C 3156 K**	**OH 3156 HTL**
280	460	118	2 160	3 750	290	1 100	1 500	91,0	**C 3060 KM**	**OH 3060 H**
	500	160	3 250	5 200	400	1 000	1 300	150	**C 3160 K**	**OH 3160 H**
300	480	121	2 280	4 000	310	1 000	1 400	95,0	**C 3064 KM**	**OH 3064 H**
	540	176	4 150	6 300	480	950	1 300	190	**C 3164 KM**	**OH 3164 H**
320	520	133	2 900	5 000	375	950	1 300	125	**C 3068 KM**	**OH 3068 H**
	580	190	4 900	7 500	560	850	1 200	235	**C 3168 KM**	**OH 3168 H**
340	480	90	1 760	3 250	250	1 000	1 400	73,0	**C 3972 KM**	**OH 3972 HE**
	540	134	2 900	5 000	375	900	1 200	135	**C 3072 KM**	**OH 3072 H**
	600	192	5 000	8 000	585	800	1 100	250	**C 3172 KM**	**OH 3172 H**
360	520	106	2 120	4 000	300	950	1 300	96,0	▶ **C 3976 KMB**	**OH 3976 HE**
	560	135	3 000	5 200	390	900	1 200	145	**C 3076 KM**	**OH 3076 H**
	620	194	4 550	7 500	540	750	1 000	290	▶ **C 3176 KMB**	**OH 3176 HE**
380	540	106	2 160	4 150	305	900	1 300	105	▶ **C 3980 KMB**	**OH 3980 HE**
	600	148	3 650	6 200	450	800	1 100	175	**C 3080 KM**	**OH 3080 H**
	650	200	5 000	8 650	610	700	950	345	**C 3180 KMB**	**OH 3180 HE**
400	560	106	2 160	4 250	310	850	1 200	105	**C 3984 KM**	**OH 3984 HE**
	620	150	3 800	6 400	465	800	1 100	180	**C 3084 KM**	**OH 3084 H**
	700	224	6 000	10 400	710	670	900	395	**C 3184 KM**	**OH 3184 H**
410	600	118	2 750	5 300	375	800	1 100	155	▶ **C 3988 KMB**	**OH 3988 HE**
	650	157	3 750	6 400	465	750	1 000	250	**C 3088 KMB**	**OH 3088 HE**
	720	226	5 700	9 300	655	670	900	475	▶ **C 3188 KMB**	**OH 3188 HE**
430	620	118	2 700	5 300	375	800	1 100	160	▶ **C 3992 KMB**	**OH 3992 HE**
	680	163	4 000	7 500	510	700	950	270	**C 3092 KM**	**OH 3092 H**
	760	240	6 800	12 000	800	600	800	540	**C 3192 KM**	**OH 3192 H**

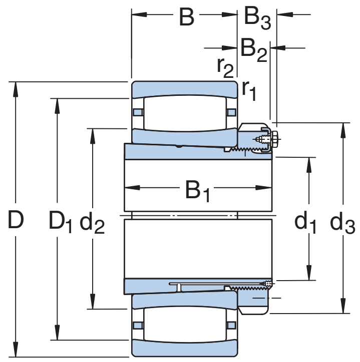
▶ Please check availability of the bearing before incorporating it in a bearing arrangement design



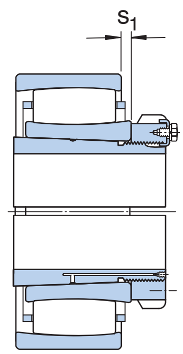
Dimensions									Abutment and fillet dimensions							Calculation factors	
d_1	d_2 ≈	d_3	D_1 ≈	B_1	B_2	$r_{1,2}$ min	s_1[1] ≈	s_2[1] ≈	d_a[2] max	d_b min	D_a min	D_a max	B_a min	C_a[3] min	r_a max	k_1	k_2
mm									mm							–	
200	257	260	310	126	30	41	3	17,2	270	231	295	327	9	3,1	2,5	0,114	0,104
	268	260	333	161	30	41	4	22,3	290	233	315	353	9	3,5	3	0,114	0,097
	259	280	350	161	35	–	4	20,5	295	233	320	383	21	1,7	3	0,113	0,101
220	276	290	329	133	34	46	3	19,2	290	251	315	347	11	1,3	2,5	0,113	0,106
	281	290	357	172	34	46	4	20,4	305	254	335	383	11	3,7	3	0,116	0,095
240	305	310	367	145	34	46	4	19,3	325	272	350	385	11	3,4	3	0,122	0,096
	314	310	394	190	34	46	4	26,4	340	276	375	423	11	4,1	3	0,115	0,096
260	328	330	389	152	38	50	4	21,3	350	292	375	405	12	1,8	3	0,121	0,098
	336	330	416	195	38	50	5	28,4	360	296	395	440	12	4,1	4	0,115	0,097
280	352	360	417	168	42	54	4	20	375	313	405	445	12	1,7	3	0,123	0,095
	362	380	448	208	40	53	5	30,5	390	318	425	480	12	4,9	4	0,106	0,106
300	376	380	440	171	42	55	4	23,3	395	334	430	465	13	1,8	3	0,121	0,098
	372	400	476	226	42	56	5	26,7	410	338	455	520	13	3,9	4	0,114	0,096
320	402	400	482	187	45	58	5	25,4	430	355	465	502	14	1,9	4	0,12	0,099
	405	440	517	254	55	72	5	25,9	445	360	490	560	14	4,2	4	0,118	0,093
340	394	420	450	144	45	58	3	17,2	405	372	440	467	14	1,6	2,5	0,127	0,104
	417	420	497	188	45	58	5	26,4	445	375	480	522	14	2	4	0,12	0,099
	423	460	537	259	58	75	5	27,9	460	380	510	580	14	3,9	4	0,117	0,094
360	429	450	489	164	48	62	4	10	425	393	490	505	15	9,7	3	–	0,128
	431	450	511	193	48	62	5	27	460	396	495	542	15	2	4	0,12	0,1
	450	490	550	264	60	77	5	19	445	401	555	600	15	16,4	4	–	0,106
380	440	470	500	168	52	66	4	10	435	413	505	525	15	9,7	3	–	0,128
	458	470	553	210	52	66	5	30,6	480	417	525	582	15	2,1	4	0,121	0,099
	485	520	589	272	62	82	6	10,1	480	421	565	624	15	4,4	5	–	0,109
400	462	490	522	168	52	66	4	21,3	480	433	515	545	15	1,8	3	0,132	0,098
	475	490	570	212	52	66	5	32,6	510	437	550	602	16	2,2	4	0,12	0,1
	508	540	618	304	70	90	6	34,8	540	443	595	674	16	3,8	5	0,113	0,098
410	495	520	564	189	60	77	4	11	490	454	565	585	17	10,5	3	–	0,119
	491	520	587	228	60	77	6	19,7	490	458	565	627	17	1,7	5	–	0,105
	514	560	633	307	70	90	6	22	510	463	635	694	17	19,1	5	–	0,102
430	508	540	577	189	60	77	4	11	505	474	580	605	17	10,4	3	–	0,12
	539	540	624	234	60	77	6	33,5	565	478	605	657	17	2,3	5	0,114	0,108
	559	580	679	326	75	95	7,5	51	570	484	655	728	17	4,2	6	0,108	0,105

[1] Permissible axial displacement from normal position of one bearing ring in relation to the other (➔ **page 40**)
[2] To clear the cage
[3] Minimum width of free space for bearings with cage in normal position (➔ **page 18**)

CARB toroidal roller bearings on adapter sleeve
d_1 **450 – 800** mm



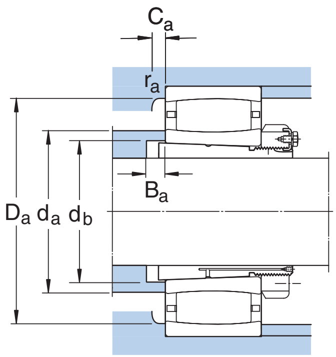
CARB on sleeve OH .. H



CARB on sleeve OH .. HE

Principal dimensions d_1	D	B	**Basic load ratings** dynamic C	static C_0	**Fatigue load limit** P_u	**Speed ratings** Reference speed	Limiting speed	**Mass** Bearing + sleeve	**Designations** Bearing	Adapter sleeve
mm			kN		kN	r/min		kg	–	
450	650	128	3 100	6 100	430	750	1 000	185	**C 3996 KM**	**OH 3996 H**
	700	165	4 050	7 800	530	670	900	275	**C 3096 KM**	**OH 3096 H**
	790	248	6 950	12 500	830	560	750	620	▶ **C 3196 KMB**	**OH 3196 HE**
470	670	128	3 150	6 300	440	700	950	195	**C 39/500 KM**	**OH 39/500 HE**
	720	167	4 250	8 300	560	630	900	305	**C 30/500 KM**	**OH 30/500 H**
	830	264	7 500	12 700	850	530	750	690	**C 31/500 KM**	**OH 31/500 H**
500	710	136	3 550	7 100	490	670	900	230	**C 39/530 KM**	**OH 39/530 HE**
	780	185	5 100	9 500	640	600	800	390	**C 30/530 KM**	**OH 30/530 H**
	870	272	8 800	15 600	1 000	500	670	770	**C 31/530 KM**	**OH 31/530 H**
530	750	140	3 600	7 350	490	600	850	260	**C 39/560 KM**	**OH 39/560 HE**
	820	195	5 600	11 000	720	530	750	440	**C 30/560 KM**	**OH 30/560 H**
	920	280	9 500	17 000	1 100	480	670	930	▶ **C 31/560 KMB**	**OH 31/560 HE**
560	800	150	4 000	8 800	570	560	750	325	**C 39/600 KM**	**OH 39/600 HE**
	870	200	6 300	12 200	780	500	700	520	**C 30/600 KM**	**OH 30/600 H**
	980	300	10 200	18 000	1 120	430	600	1 100	▶ **C 31/600 KMB**	**OH 31/600 HE**
600	850	165	4 650	10 000	640	530	700	420	**C 39/630 KM**	**OH 39/630 HE**
	920	212	6 800	12 900	830	480	670	635	**C 30/630 KM**	**OH 30/630 H**
	1 030	315	12 200	22 000	1 370	400	560	1 280	▶ **C 31/630 KMB**	**OH 31/630 HE**
630	900	170	4 900	11 200	695	480	630	455	**C 39/670 KM**	**OH 39/670 H**
	980	230	8 150	16 300	1 000	430	600	750	**C 30/670 KM**	**OH 30/670 H**
	1 090	336	12 000	22 000	1 320	380	530	1 550	▶ **C 31/670 KMB**	**OH 31/670 HE**
670	950	180	6 000	12 500	780	450	630	520	**C 39/710 KM**	**OH 39/710 HE**
	1 030	236	8 800	17 300	1 060	400	560	865	**C 30/710 KM**	**OH 30/710 H**
	1 150	345	12 700	24 000	1 430	360	480	1 800	▶ **C 31/710 KMB**	**OH 31/710 HE**
710	1 000	185	6 100	13 400	815	430	560	590	**C 39/750 KM**	**OH 39/750 HE**
	1 090	250	9 000	18 000	1 100	380	530	1 000	▶ **C 30/750 KMB**	**OH 30/750 HE**
	1 220	365	16 000	30 500	1 800	320	450	2 150	▶ **C 31/750 KMB**	**OH 31/750 HE**
750	1 060	195	6 400	14 600	865	380	530	715	**C 39/800 KM**	**OH 39/800 HE**
	1 150	258	9 150	18 600	1 120	360	480	1 150	▶ **C 30/800 KMB**	**OH 30/800 HE**
	1 280	375	15 600	30 500	1 760	300	400	2 400	▶ **C 31/800 KMB**	**OH 31/800 HE**
800	1 120	200	7 350	16 300	965	360	480	785	**C 39/850 KM**	**OH 39/850 HE**
	1 220	272	11 200	24 000	1 370	320	430	1 050	▶ **C 30/850 KMB**	**OH 30/850 HE**
	1 360	400	16 000	32 000	1 830	280	380	2 260	▶ **C 31/850 KMB**	**OH 31/850 HE**

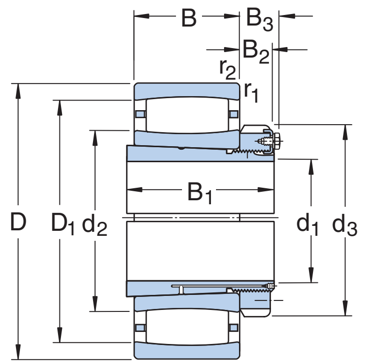
▶ Please check availability of the bearing before incorporating it in a bearing arrangement design



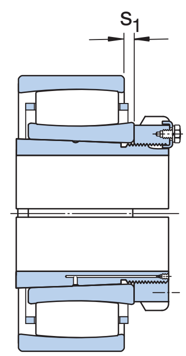
Dimensions									Abutment and fillet dimensions							Calculation factors	
d_1	d_2 ≈	d_3	D_1 ≈	B_1	B_2	$r_{1,2}$ min	s_1[1] ≈	s_2[1] ≈	d_a[2] max	d_b min	D_a min	D_a max	B_a min	C_a[3] min	r_a max	k_1	k_2
mm									mm							–	
450	529	560	604	200	60	77	5	20,4	550	496	590	632	18	2	4	0,133	0,095
	555	560	640	237	60	77	6	35,5	580	499	625	677	18	2,3	5	0,113	0,11
	583	620	700	335	75	95	7,5	24	580	505	705	758	18	20,6	6	–	0,104
470	556	580	631	208	68	85	5	20,4	580	516	615	652	18	2	4	0,135	0,095
	572	580	656	247	68	85	6	37,5	600	519	640	697	18	2,3	5	0,113	0,111
	605	630	738	356	80	100	7,5	75,3	655	527	705	798	18	–	6	0,099	0,116
500	578	630	657	216	68	90	5	28,4	600	547	640	692	20	2,2	4	0,129	0,101
	601	630	704	265	68	90	6	35,7	635	551	685	757	20	2,5	5	0,12	0,101
	635	670	781	364	80	105	7,5	44,4	680	558	745	838	20	4,8	6	0,115	0,097
530	622	650	701	227	75	97	5	32,4	645	577	685	732	20	2,3	4	0,128	0,104
	660	650	761	282	75	97	6	45,7	695	582	740	797	20	2,7	5	0,116	0,106
	664	710	808	377	85	110	7,5	28	660	589	810	888	20	23,8	6	–	0,111
560	666	700	744	239	75	97	5	32,4	685	619	725	782	22	2,4	4	0,131	0,1
	692	700	805	289	75	97	6	35,9	725	623	775	847	22	2,7	5	0,125	0,098
	710	750	870	399	85	110	7,5	30	705	632	875	948	22	25,4	6	–	0,105
600	700	730	784	254	75	97	6	35,5	720	650	770	827	22	2,4	5	0,121	0,11
	717	730	840	301	75	97	7,5	48,1	755	654	810	892	22	2,9	6	0,118	0,104
	749	800	919	424	95	120	7,5	31	745	663	920	998	22	26,8	6	–	0,109
630	764	780	848	264	80	102	6	40,5	765	691	830	877	22	2,5	5	0,121	0,113
	775	780	904	324	80	102	7,5	41,1	820	696	875	952	22	2,9	6	0,121	0,101
	797	850	963	456	106	131	7,5	33	795	705	965	1 058	22	28	6	–	0,104
670	773	830	877	286	90	112	6	30,7	795	732	850	927	26	2,7	5	0,131	0,098
	807	830	945	342	90	112	7,5	47,3	850	736	910	1 002	26	3,2	6	0,119	0,104
	848	900	1 012	467	106	135	9,5	34	845	745	1 015	1 110	26	28,6	8	–	0,102
710	830	870	933	291	90	112	6	35,7	855	772	910	977	26	2,7	5	0,131	0,101
	858	870	993	356	90	112	7,5	25	855	778	995	1 062	26	21,8	6	–	0,112
	888	950	1 076	493	112	141	9,5	36	885	787	1 080	1 180	26	31,5	8	–	0,117
750	889	920	990	303	90	112	6	45,7	915	825	970	1 037	28	2,9	5	0,126	0,106
	913	920	1 047	366	90	112	7,5	25	910	829	1 050	1 122	28	22,3	6	–	0,111
	947	1 000	1 133	505	112	141	9,5	37	945	838	1 135	1 240	28	32,1	8	–	0,115
800	940	980	1 053	308	90	115	6	35,9	960	876	1 025	1 097	28	2,9	5	0,135	0,098
	968	980	1 113	380	90	115	7,5	27	965	880	1 115	1 192	28	24,1	6	–	0,124
	1 020	1 060	1 200	536	118	147	12	40	1 015	890	1 205	1 312	28	33,5	10	–	0,11

[1] Permissible axial displacement from normal position of one bearing ring in relation to the other (➔ **page 40**)
[2] To clear the cage
[3] Minimum width of free space for bearings with cage in normal position (➔ **page 18**)

CARB toroidal roller bearings on adapter sleeve
d_1 **850 – 1 000** mm



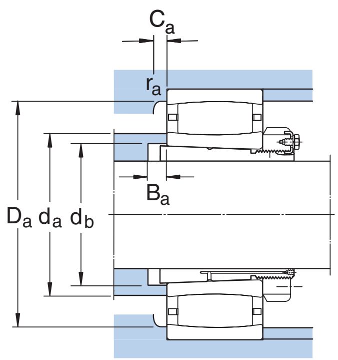
CARB on sleeve OH .. H



CARB on sleeve OH .. HE

Principal dimensions			**Basic load ratings** dynamic	static	**Fatigue load limit**	**Speed ratings** Reference speed	Limiting speed	**Mass** Bearing + sleeve	**Designations** Bearing	Adapter sleeve
d_1	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
850	1 180	206	8 150	18 000	1 060	340	450	900	▶ **C 39/900 KMB**	**OH 39/900 HE**
	1 280	280	12 700	26 500	1 530	300	400	1 520	**C 30/900 KM**	**OH 30/900 H**
900	1 250	224	9 300	22 000	1 250	300	430	1 100	**C 39/950 KM**	**OH 39/950 HE**
	1 360	300	12 900	27 500	1 560	280	380	1 800	▶ **C 30/950 KMB**	**OH 30/950 HE**
950	1 420	308	13 400	29 000	1 630	260	340	2 000	▶ **C 30/1000 KMB**	**OH 30/1000 HE**
	1 580	462	22 800	45 500	2 500	220	300	4 300	▶ **C 31/1000 KMB**	**OH 31/1000 HE**
1 000	1 400	250	12 500	29 000	1 600	260	340	1 500	▶ **C 39/1060 KMB**	**OH 39/1060 HE**

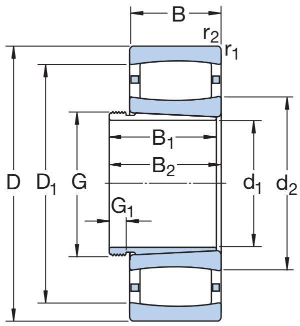
▶ Please check availability of the bearing before incorporating it in a bearing arrangement design

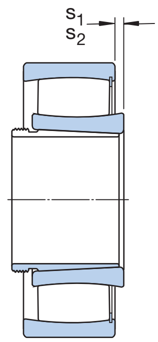


Dimensions									Abutment and fillet dimensions							Calculation factors	
d_1	d_2 ≈	d_3	D_1 ≈	B_1	B_2	$r_{1,2}$ min	s_1[1] ≈	s_2[1] ≈	d_a[2] max	d_b min	D_a min	D_a max	B_a min	C_a[3] min	r_a max	k_1	k_2
mm									mm							–	
850	989	1 030	1 113	326	100	125	6	20	985	924	1 115	1 157	30	18,4	5	–	0,132
	1 008	1 030	1 172	400	100	125	7,5	45,8	1 050	931	1 130	1 252	30	3,4	6	0,124	0,1
900	1 044	1 080	1 167	344	100	125	7,5	35	1 080	976	1 145	1 222	30	3,1	6	0,134	0,098
	1 080	1 080	1 240	420	100	125	7,5	30	1 075	983	1 245	1 332	30	26,2	6	–	0,116
950	1 136	1 140	1 294	430	100	125	7,5	30	1 135	1 034	1 295	1 392	33	26,7	6	–	0,114
	1 179	1 240	1 401	609	125	154	12	46	1 175	1 047	1 405	1 532	33	38,6	10	–	0,105
1 000	1 175	1 200	1 323	372	100	125	7,5	25	1 170	1 090	1 325	1 392	33	23,4	6	–	0,142

[1] Permissible axial displacement from normal position of one bearing ring in relation to the other (➔ **page 40**)
[2] To clear the cage
[3] Minimum width of free space for bearings with cage in normal position (➔ **page 18**)

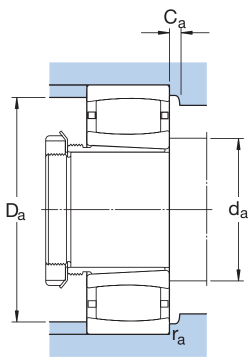
CARB toroidal roller bearings on withdrawal sleeve
d_1 **35 – 95** mm





Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass Bearing + sleeve	Designations Bearing	Withdrawal sleeve
d_1	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
35	80	23	90	86,5	10,2	8 000	11 000	0,59	**C 2208 KTN9**	**AH 308**
	80	23	102	104	12	–	4 500	0,62	**C 2208 KV**	**AH 308**
40	85	23	93	93	10,8	8 000	11 000	0,67	**C 2209 KTN9**	**AH 309**
	85	23	106	110	12,9	–	4 300	0,70	**C 2209 KV**	**AH 309**
45	90	23	98	100	11,8	7 000	9 500	0,72	**C 2210 KTN9**	**AHX 310**
	90	23	114	122	14,3	–	3 800	0,75	**C 2210 KV**	**AHX 310**
50	100	25	116	114	13,4	6 700	9 000	0,95	**C 2211 KTN9**	**AHX 311**
	100	25	132	134	16	–	3 400	0,97	**C 2211 KV**	**AHX 311**
55	110	28	143	156	18,3	5 600	7 500	1,30	**C 2212 KTN9**	**AHX 312**
	110	28	166	190	22,4	–	2 800	1,35	**C 2212 KV**	**AHX 312**
60	120	31	180	180	21,2	5 300	7 500	1,60	**C 2213 KTN9**	**AH 313 G**
	120	31	204	216	25,5	–	2 400	1,70	**C 2213 KV**	**AH 313 G**
65	125	31	186	196	23,2	5 000	7 000	1,70	**C 2214 KTN9**	**AH 314 G**
	125	31	212	228	27	–	2 400	1,75	**C 2214 KV**	**AH 314 G**
	150	51	405	430	49	3 800	5 000	4,65	**C 2314 K**	**AHX 2314 G**
70	130	31	196	208	25,5	4 800	6 700	1,90	**C 2215 K**	**AH 315 G**
	130	31	220	240	29	–	2 200	1,95	**C 2215 KV**	**AH 315 G**
	160	55	425	465	52	3 600	4 800	5,65	**C 2315 K**	**AHX 2315 G**
75	140	33	220	250	28,5	4 500	6 000	2,35	**C 2216 K**	**AH 316**
	140	33	255	305	34,5	–	2 000	2,45	**C 2216 KV**	**AH 316**
	170	58	510	550	61	3 400	4 500	6,75	**C 2316 K**	**AHX 2316**
80	150	36	275	320	36,5	4 300	5 600	3,00	**C 2217 K**	**AHX 317**
	150	36	315	390	44	–	1 800	3,20	**C 2217 KV**	**AHX 317**
	180	60	540	600	65,5	3 200	4 300	7,90	**C 2317 K**	**AHX 2317**
85	160	40	325	380	42,5	3 800	5 300	3,75	**C 2218 K**	**AHX 318**
	160	40	365	440	49	–	1 500	3,85	**C 2218 KV**	**AHX 318**
	190	64	610	695	73,5	2 800	4 000	9,00	**C 2318 K**	**AHX 2318**
90	170	43	360	400	44	3 800	5 000	4,50	► **C 2219 K**	**AHX 319**
	200	67	610	695	73,5	2 800	4 000	11,0	**C 2319 K**	**AHX 2319**
95	165	52	415	540	58,5	3 200	4 300	5,00	► **C 3120 K**	**AHX 3120**
	165	52	475	655	69,5	–	1 300	5,00	**C 3120 KV**	**AHX 3120**
	180	46	415	465	47,5	3 600	4 800	5,30	**C 2220 K**	**AHX 320**
	215	73	800	880	91,5	2 600	3 600	13,5	**C 2320 K**	**AHX 2320**

► Please check availability of the bearing before incorporating it in a bearing arrangement design



3

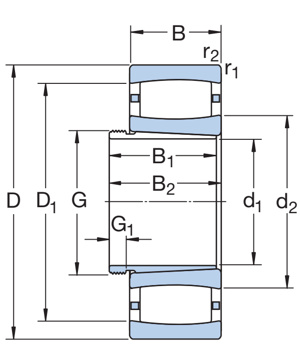
Dimensions										**Abutment and fillet dimensions**						**Calculation factors**	
d_1	d_2 ≈	D_1 ≈	B_1	B_2[1)]	G	G_1	$r_{1,2}$ min	s_1[2)] ≈	s_2[2)] ≈	d_a[3)] min	d_a max	D_a[4)] min	D_a max	C_a[5)] min	r_a max	k_1	k_2
mm										mm						–	
35	52,4	69,9	29	32	M 45×1,5	6	1,1	7,1	–	47	52	68	73	0,3	1	0,093	0,128
	52,4	69,9	29	32	M 45×1,5	6	1,1	7,1	4,1	47	66	–	73	–	1	0,093	0,128
40	55,6	73,1	31	34	M 50×1,5	6	1,1	7,1	–	52	55	71	78	0,3	1	0,095	0,128
	55,6	73,1	31	34	M 50×1,5	6	1,1	7,1	4,1	52	69	–	78	–	1	0,095	0,128
45	61,9	79,4	35	38	M 55×2	7	1,1	7,1	–	57	61	77	83	0,8	1	0,097	0,128
	61,9	79,4	35	38	M 55×2	7	1,1	7,1	3,9	57	73	–	83	–	1	0,097	0,128
50	65,8	86,7	37	40	M 60×2	7	1,5	8,6	–	64	65	84	91	0,3	1,5	0,094	0,133
	65,8	86,7	37	40	M 60×2	7	1,5	8,6	5,4	64	80	–	91	–	1,5	0,094	0,133
55	77,1	97,9	40	43	M 65×2	8	1,5	8,5	–	69	77	95	101	0,3	1,5	0,1	0,123
	77,1	97,9	40	43	M 65×2	8	1,5	8,5	5,3	69	91	–	101	–	1,5	0,1	0,123
60	79	106	42	45	M 70×2	8	1,5	9,6	–	74	79	102	111	0,2	1,5	0,097	0,127
	79	106	42	45	M 70×2	8	1,5	9,6	5,3	74	97	–	111	–	1,5	0,097	0,127
65	83,7	111	43	47	M 75×2	8	1,5	9,6	–	79	83	107	116	0,4	1,5	0.098	0,127
	83,7	111	43	47	M 75×2	8	1,5	9,6	5,3	79	102	–	116	–	1,5	0,098	0,127
	91,4	130	64	68	M 75×2	12	2,1	9,1	–	82	105	120	138	2,2	2	0,11	0,099
70	88,5	115	45	49	M 80×2	8	1,5	9,6	–	84	98	110	121	1,2	1,5	0,099	0,127
	88,5	115	45	49	M 80×2	8	1,5	9,6	5,3	84	105	–	121	–	1,5	0,099	0,127
	98,5	135	68	72	M 80×2	12	2,1	13,1	–	87	110	130	148	2,2	2	0,103	0,107
75	98,1	125	48	52	M 90×2	8	2	9,1	–	91	105	120	129	1,2	2	0,104	0,121
	98,1	125	48	52	M 90×2	8	2	9,1	4,8	91	115	–	129	–	2	0,104	0,121
	102	145	71	75	M 90×2	12	2,1	10,1	–	92	115	135	158	2,4	2	0,107	0,101
80	104	133	52	56	M 95×2	9	2	7,1	–	96	110	125	139	1,3	2	0,114	0,105
	104	133	52	56	M 95×2	9	2	7,1	1,7	96	115	–	139	–	2	0,114	0,105
	110	153	74	78	M 95×2	13	3	12,1	–	99	125	145	166	2,4	2,5	0,105	0,105
85	112	144	53	57	M 100×2	9	2	9,5	–	101	120	130	149	1,4	2	0,104	0,117
	112	144	53	57	M 100×2	9	2	9,5	5,4	101	125	–	149	–	2	0,104	0,117
	119	166	79	83	M 100×2	14	3	9,6	–	104	135	155	176	2	2,5	0,108	0,101
90	113	149	57	61	M 105×2	10	2,1	10,5	–	107	112	149	158	4,2	2	0,114	0,104
	120	166	85	89	M 105×2	16	3	12,6	–	109	135	155	186	2,1	2,5	0,103	0,106
95	119	150	64	68	M 110×2	11	2	10	–	111	119	150	154	4,5	2	0,1	0,112
	119	150	64	68	M 110×2	11	2	10	4,7	111	130	–	154	–	2	0,1	0,112
	118	157	59	63	M 110×2	10	2,1	10,1	–	112	130	150	168	0.9	2	0,108	0,11
	126	185	90	94	M 110×2	16	3	11.2	–	114	150	170	201	3,2	2,5	0,113	0,096

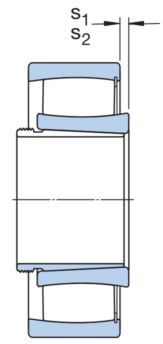
1) Width before sleeve is driven into bearing bore
2) Permissible axial displacement from normal position of one bearing ring in relation to the other (➔ **page 40**)
3) To clear the cage for caged bearings or to clear the snap ring for full complement bearings
4) To clear the cage for caged bearings
5) Minimum width of free space for bearings with cage in normal position (➔ **page 18**)

Page 3

Page 12

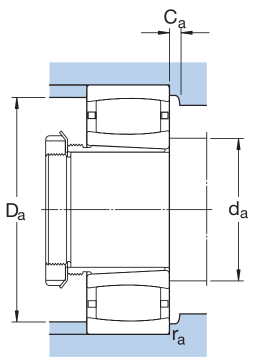
CARB toroidal roller bearings on withdrawal sleeve
d_1 **105 – 160** mm





Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass Bearing + sleeve	Designations Bearing	Withdrawal sleeve
d_1	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
105	170	45	355	480	51	3 200	4 500	4,25	▶ **C 3022 K**	**AHX 3122**
	180	69	670	1 000	102	–	900	7,75	**C 4122 K30V**	**AH 24122**
	200	53	530	620	64	3 200	4 300	7,65	**C 2222 K**	**AHX 3122**
115	180	46	375	530	55	3 000	4 000	4,60	**C 3024 K**	**AHX 3024**
	180	46	430	640	67	–	1 400	4,75	**C 3024 KV**	**AHX 3024**
	180	60	530	880	90	–	1 100	6,20	**C 4024 K30V**	**AH 24024**
	200	80	780	1 120	114	–	750	11,5	▶ **C 4124 K30V**	**AH 24124**
	215	58	610	710	72	3 000	4 000	9,50	▶ **C 2224 K**	**AHX 3124**
	215	76	750	980	98	2 400	3 200	13,0	**C 3224 K**	**AHX 3224 G**
125	200	52	390	585	58,5	2 800	3 800	6,80	▶ **C 3026 K**	**AHX 3026**
	200	69	620	930	91,5	1 900	2 800	8,70	**C 4026 K30**	**AH 24026**
	200	69	720	1 120	112	–	850	8,90	**C 4026 K30V**	**AH 24026**
	210	80	750	1 100	108	–	670	11,5	**C 4126 K30V/VE240**	**AH 24126**
	230	64	735	930	93	2 800	3 800	12,0	**C 2226 K**	**AHX 3126**
135	210	53	490	735	72	2 600	3 400	7,30	▶ **C 3028 K**	**AHX 3028**
	210	69	750	1 220	118	–	800	9,50	**C 4028 K30V**	**AH 24028**
	225	85	1 000	1 600	153	–	630	15,5	**C 4128 K30V**	**AH 24128**
	250	68	830	1 060	102	2 400	3 400	15,5	**C 2228 K**	**AHX 3128**
145	225	56	540	850	83	2 400	3 200	9,40	**C 3030 KMB**	**AHX 3030**
	225	75	780	1 320	125	–	750	11,5	**C 4030 K30V**	**AH 24030**
	250	80	880	1 290	122	2 000	2 800	16,5	**C 3130 K**	**AHX 3130 G**
	250	100	1 220	1 860	173	–	450	22,0	▶ **C 4130 K30V**	**AH 24130**
	270	73	980	1 220	116	2 400	3 200	19,0	**C 2230 K**	**AHX 3130 G**
150	240	60	600	980	93	2 200	3 000	11,5	▶ **C 3032 K**	**AH 3032**
	240	80	795	1 160	110	1 600	2 400	14,7	**C 4032 K30**	**AH 24032**
	240	80	915	1 460	140	–	600	15,0	**C 4032 K30V**	**AH 24032**
	270	86	1 000	1 400	132	2 000	2 600	23,0	▶ **C 3132 K**	**AH 3132 G**
	270	109	1 460	2 160	200	–	300	29,0	▶ **C 4132 K30V**	**AH 24132**
	290	104	1 370	1 830	170	1 700	2 400	31,0	**C 3232 K**	**AH 3232 G**
160	260	67	750	1 160	108	2 000	2 800	15,0	▶ **C 3034 K**	**AH 3034**
	260	90	1 140	1 860	170	–	480	20,0	**C 4034 K30V**	**AH 24034**
	280	88	1 040	1 460	137	1 900	2 600	24,0	▶ **C 3134 K**	**AH 3134 G**
	280	109	1 530	2 280	208	–	280	30,0	▶ **C 4134 K30V**	**AH 24134**
	310	86	1 270	1 630	150	2 000	2 600	31,0	**C 2234 K**	**AH 3134 G**

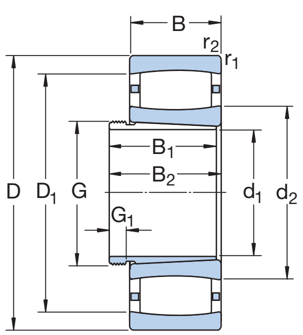
▶ Please check availability of the bearing before incorporating it in a bearing arrangement design

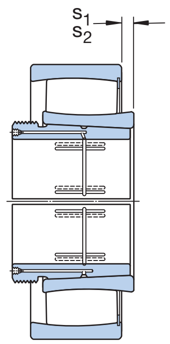


Dimensions										**Abutment and fillet dimensions**						**Calculation factors**	
d_1	d_2 ≈	D_1 ≈	B_1	B_2[1]	G	G_1	$r_{1,2}$ min	s_1[2] ≈	s_2[2] ≈	d_a[3] min	d_a max	D_a[4] min	D_a max	C_a[5] min	r_a max	k_1	k_2
mm										mm						–	
105	128	156	68	72	M 120×2	11	2	9,5	–	119	127	157	161	4	2	0,107	0,11
	132	163	82	91	M 115×2	13	2	11,4	4,6	120	145	–	170	–	2	0,111	0,097
	132	176	68	72	M 120×2	11	2,1	11,1	–	122	150	165	188	1,9	2	0,113	0,103
115	138	166	60	64	M 130×2	13	2	10,6	–	129	145	160	171	0,9	2	0,111	0,109
	138	166	60	64	M 130×2	13	2	10,6	3,8	129	150	–	171	–	2	0,111	0,109
	140	164	73	82	M 125×2	13	2	12	5,2	129	150	–	171	–	2	0,109	0,103
	140	176					2	18	11,2	131	140	–	189	–	2	0,103	0,103
	144	191	75	79	M 130×2	12	2,1	13	–	132	143	192	203	5,4	2	0,113	0,103
	149	190	90	94	M 130×2	13	2,1	17,1	–	132	160	180	203	2,4	2	0,103	0,108
125	154	180	67	71	M 140×2	14	2	16,5	–	139	152	182	191	4,4	2	0,123	0,1
	149	181	83	93	M 140×2	14	2	11,4	–	139	155	175	191	1,9	2	0,113	0,097
	149	181	83	93	M 135×2	14	2	11,4	4,6	139	165	–	191	–	2	0,113	0,097
	153	190	94	104	M 140×2	14	2	9,7	9,7	141	170	–	199	–	2	0,09	0,126
	152	199	78	82	M 140×2	12	3	9,6	–	144	170	185	216	1,1	2,5	0,113	0,101
135	163	194	68	73	M 150×2	14	2	11	–	149	161	195	201	4,7	2	0,102	0,116
	161	193	83	93	M 145×2	14	2	11,4	5,9	149	175	–	201	–	2	0,115	0,097
	167	203	99	109	M 150×2	14	2,1	12	5,2	151	185	–	214	–	2	0,111	0,097
	173	223	83	88	M 150×2	14	3	13,7	–	154	190	210	236	2,3	2,5	0,109	0,108
145	173	204	72	77	M 160×3	15	2,1	2,8	–	161	172	200	214	1,3	2	–	0,108
	173	204	90	101	M 155×3	15	2,1	17,4	10,6	161	185	–	214	–	2	0,107	0,106
	182	226	96	101	M 160×3	15	2,1	13,9	–	162	195	215	238	2,3	2	0,12	0,092
	179	222	115	126	M 160×3	15	2,1	20	10,1	162	175	–	228	–	2	0,103	0,103
	177	236	96	101	M 160×3	15	3	11,2	–	164	200	215	256	2,5	2,5	0,119	0,096
150	187	218	77	82	M 170×3	16	2,1	15	–	171	186	220	229	5,1	2	0,115	0,106
	181	217	95	106	M 170×3	15	2,1	18,1	–	171	190	210	229	2,2	2	0,109	0,103
	181	217	95	106	M 170×3	15	2,1	18,1	8,2	171	195	–	229	–	2	0,109	0,103
	191	240	103	108	M 170×3	16	2,1	19	–	172	190	242	258	7,5	2	0,099	0,111
	190	241	124	135	M 170×3	15	2,1	21	11,1	172	190	–	258	–	2	0,101	0,105
	194	256	124	130	M 170×3	20	3	19,3	–	174	215	245	276	2,6	2,5	0,112	0,096
160	200	237	85	90	M 180×3	17	2,1	12,5	–	181	200	238	249	5,8	2	0,105	0,112
	195	235	106	117	M 180×3	16	2,1	17,1	7,2	181	215	–	249	–	2	0,108	0,103
	200	249	104	109	M 180×3	16	2,1	21	–	182	200	250	268	7,6	2	0,101	0,109
	200	251	125	136	M 180×3	16	2,1	21	11,1	182	200	–	268	–	2	0,101	0,106
	209	274	104	109	M 180×3	16	4	16,4	–	187	230	255	293	3	3	0,114	0,1

[1] Width before sleeve is driven into bearing bore
[2] Permissible axial displacement from normal position of one bearing ring in relation to the other (➔ **page 40**)
[3] To clear the cage for caged bearings or to clear the snap ring for full complement bearings
[4] To clear the cage for caged bearings
[5] Minimum width of free space for bearings with cage in normal position (➔ **page 18**)

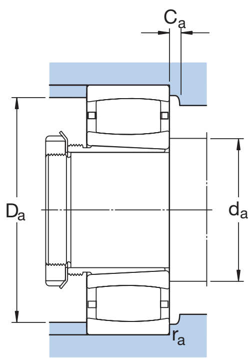
CARB toroidal roller bearings on withdrawal sleeve
d_1 **170 – 340** mm





Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass Bearing + sleeve		Designations Bearing	Withdrawal sleeve
d_1	D	B	C	C_0	P_u						
mm			kN		kN	r/min		kg		–	
170	280	74	880	1 340	125	1 900	2 600	19,0		**C 3036 K**	**AH 3036**
	280	100	1 320	2 120	193	–	430	26,0		**C 4036 K30V**	**AH 24036**
	300	96	1 250	1 730	156	1 800	2 400	30,0		**C 3136 K**	**AH 3136 G**
	300	118	1 760	2 700	240	–	220	38,0	▶	**C 4136 K30V**	**AH 24136**
	320	112	1 530	2 200	196	1 500	2 000	41,5		**C 3236 K**	**AH 3236 G**
180	290	75	930	1 460	132	1 800	2 400	20,5		**C 3038 K**	**AH 3038 G**
	290	100	1 370	2 320	204	–	380	28,0	▶	**C 4038 K30V**	**AH 24038**
	320	104	1 530	2 200	196	1 600	2 200	38,0	▶	**C 3138 K**	**AH 3138 G**
	320	128	2 040	3 150	275	–	130	47,5	▶	**C 4138 K30V**	**AH 24138**
	340	92	1 370	1 730	156	1 800	2 400	38,0		**C 2238 K**	**AH 2238 G**
190	310	82	1 120	1 730	153	1 700	2 400	25,5		**C 3040 K**	**AH 3040 G**
	310	109	1 630	2 650	232	–	260	34,5	▶	**C 4040 K30V**	**AH 24040**
	340	112	1 600	2 320	204	1 500	2 000	45,5		**C 3140 K**	**AH 3140**
	340	140	2 360	3 650	315	–	80	59,0	▶	**C 4140 K30V**	**AH 24140**
200	340	90	1 320	2 040	176	1 600	2 200	36,0		**C 3044 K**	**AOH 3044 G**
	340	118	1 930	3 250	275	–	200	48,0	▶	**C 4044 K30V**	**AOH 24044**
	370	120	1 900	2 900	245	1 400	1 900	60,0		**C 3144 K**	**AOH 3144**
	400	108	2 000	2 500	216	1 500	2 000	65,5		**C 2244 K**	**AOH 2244**
220	360	92	1 340	2 160	180	1 400	2 000	39,5		**C 3048 K**	**AOH 3048**
	400	128	2 320	3 450	285	1 300	1 700	75,0		**C 3148 K**	**AOH 3148**
240	400	104	1 760	2 850	232	1 300	1 800	55,5		**C 3052 K**	**AOH 3052**
	440	144	2 650	4 050	325	1 100	1 500	102		**C 3152 K**	**AOH 3152 G**
260	420	106	1 860	3 100	250	1 200	1 600	61,0		**C 3056 K**	**AOH 3056**
	460	146	2 850	4 500	355	1 100	1 400	110		**C 3156 K**	**AOH 3156 G**
280	460	118	2 160	3 750	290	1 100	1 500	84,0		**C 3060 KM**	**AOH 3060**
	460	160	2 900	4 900	380	850	1 200	110		**C 4060 K30M**	**AOH 24060 G**
	500	160	3 250	5 200	400	1 000	1 300	140		**C 3160 K**	**AOH 3160 G**
300	480	121	2 280	4 000	310	1 000	1 400	93,0		**C 3064 KM**	**AOH 3064 G**
	540	176	4 150	6 300	480	950	1 300	185		**C 3164 KM**	**AOH 3164 G**
320	520	133	2 900	5 000	375	950	1 300	120		**C 3068 KM**	**AOH 3068 G**
	580	190	4 900	7 500	560	850	1 200	230		**C 3168 KM**	**AOH 3168 G**
340	540	134	2 900	5 000	375	900	1 200	125		**C 3072 KM**	**AOH 3072 G**
	600	192	5 000	8 000	585	800	1 100	245		**C 3172 KM**	**AOH 3172 G**

▶ Please check availability of the bearing before incorporating it in a bearing arrangement design

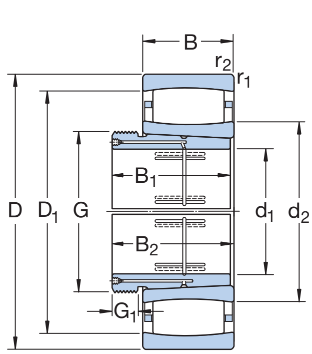


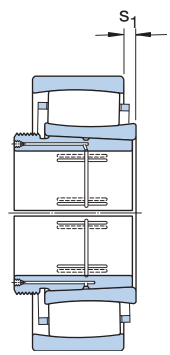
Dimensions										Abutment and fillet dimensions						Calculation factors	
d_1	d_2 ≈	D_1 ≈	B_1	B_2[1)]	G	G_1	$r_{1,2}$ min	s_1[2)] ≈	s_2[2)] ≈	d_a[3)] min	d_a max	D_a[4)] min	D_a max	C_a[5)] min	r_a max	k_1	k_2
mm										mm						–	
170	209	251	92	98	M 190×3	17	2,1	15,1	–	191	220	240	269	2	2	0,112	0,105
	203	247	116	127	M 190×3	16	2,1	20,1	10,2	191	225	–	269	–	2	0,107	0,103
	210	266	116	122	M 190×3	19	3	23,2	–	194	230	255	286	2,2	2,5	0,102	0,111
	211	265	134	145	M 190×3	16	3	20	10,1	194	210	–	286	–	2,5	0,095	0,11
	228	289	140	146	M 190×3	24	4	27,3	–	197	245	275	303	3,2	3	0,107	0,104
180	225	266	96	102	M 200×3	18	2,1	16,1	–	201	235	255	279	1,9	2	0,113	0,107
	220	263	118	131	M 200×3	18	2,1	20	10,1	201	220	–	279	–	2	0,103	0,106
	228	289	125	131	M 200×3	20	3	19	–	204	227	290	306	9,1	2,5	0,096	0,113
	222	284	146	159	M 200×3	18	3	20	10,1	204	220	–	306	–	2,5	0,094	0,111
	224	296	112	117	M 200×3	18	4	22,5	–	207	250	275	323	1,6	3	0,108	0,108
190	235	285	102	108	Tr 210×4	19	2,1	15,2	–	211	250	275	299	2,9	2	0,123	0,095
	229	280	127	140	Tr 210×4	18	2,1	21	11,1	211	225	–	299	–	2	0,101	0,108
	245	305	134	140	Tr 220×4	21	3	27,3	–	214	260	307	326	–	2,5	0,108	0,104
	237	302	158	171	Tr 210×4	18	3	22	12,1	214	235	–	326	–	2,5	0,092	0,112
200	257	310	111	117	Tr 230×4	20	3	17,2	–	233	270	295	327	3,1	2,5	0,114	0,104
	251	306	138	152	Tr 230×4	20	3	20	10,1	233	250	–	327	–	2,5	0,095	0,113
	268	333	145	151	Tr 240×4	23	4	22,3	–	237	290	315	353	3,5	3	0,114	0,097
	259	350	145	151	Tr 240×4	23	4	20,5	–	237	295	320	383	1,7	3	0,113	0,101
220	276	329	116	123	Tr 260×4	21	3	19,2	–	253	290	315	347	1,3	2,5	0,113	0,106
	281	357	154	161	Tr 260×4	25	4	20,4	–	257	305	335	383	3,7	3	0,116	0,095
240	305	367	128	135	Tr 280×4	23	4	19,3	–	275	325	350	385	3,4	3	0,122	0,096
	314	394	172	179	Tr 280×4	26	4	26,4	–	277	340	375	423	4,1	3	0,115	0,096
260	328	389	131	139	Tr 300×4	24	4	21,3	–	295	350	375	405	1,8	3	0,121	0,098
	336	416	175	183	Tr 300×5	28	5	28,4	–	300	360	395	440	4,1	4	0,115	0,097
280	352	417	145	153	Tr 320×5	26	4	20	–	315	375	405	445	1,7	3	0,123	0,095
	338	409	184	202	Tr 320×5	24	4	30,4	–	315	360	400	445	2,8	3	0,105	0,106
	362	448	192	200	Tr 320×5	30	5	30,5	–	320	390	425	480	4,9	4	0,106	0,106
300	376	440	149	157	Tr 340×5	27	4	23,3	–	335	395	430	465	1,8	3	0,121	0,098
	372	476	209	217	Tr 340×5	31	5	26,7	–	340	410	455	520	3,9	4	0,114	0,096
320	402	482	162	171	Tr 360×5	28	5	25,4	–	358	430	465	502	1,9	4	0,12	0,099
	405	517	225	234	Tr 360×5	33	5	25,9	–	360	445	490	560	4,2	4	0,118	0,093
340	417	497	167	176	Tr 380×5	30	5	26,4	–	378	445	480	522	2	4	0,12	0,099
	423	537	229	238	Tr 380×5	35	5	27,9	–	380	460	510	522	3,9	4	0,117	0,094

1) Width before sleeve is driven into bearing bore
2) Permissible axial displacement from normal position of one bearing ring in relation to the other (➔ **page 40**)
3) To clear the cage for caged bearings or to clear the snap ring for full complement bearings
4) To clear the cage for caged bearings
5) Minimum width of free space for bearings with cage in normal position (➔ **page 18**)

CARB toroidal roller bearings on withdrawal sleeve

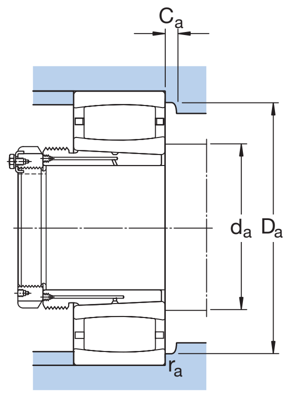
d_1 **360 – 670** mm





Principal dimensions d_1	D	B	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Speed ratings Reference speed	Limiting speed	Mass Bearing + sleeve	Designations Bearing	Withdrawal sleeve
mm			kN		kN	r/min		kg	–	
360	560	135	3 000	5 200	390	900	1 200	130	**C 3076 KM**	**AOH 3076 G**
	620	194	4 550	7 500	540	750	1 000	260	▶ **C 3176 KMB**	**AOH 3176 G**
380	600	148	3 650	6 200	450	800	1 100	165	**C 3080 KM**	**AOH 3080 G**
	650	200	5 000	8 650	610	700	950	310	**C 3180 KMB**	**AOH 3180 G**
400	620	150	3 800	6 400	465	850	1 200	175	**C 3084 KM**	**AOH 3084 G**
	700	224	6 000	10 400	710	800	1 100	380	**C 3184 KM**	**AOH 3184 G**
420	650	157	3 750	6 400	465	800	1 100	215	**C 3088 KMB**	**AOHX 3088 G**
	720	226	5 700	9 300	655	670	900	405	▶ **C 3188 KMB**	**AOHX 3188 G**
440	680	163	4 000	7 500	510	700	950	230	**C 3092 KM**	**AOHX 3092 G**
	760	240	6 800	12 000	800	600	800	480	**C 3192 KM**	**AOHX 3192 G**
	760	300	8 300	14 300	950	480	630	585	**C 4192 K30M**	**AOH 24192**
460	700	165	4 050	7 800	530	670	900	245	**C 3096 KM**	**AOHX 3096 G**
	790	248	6 950	12 500	830	560	750	545	▶ **C 3196 KMB**	**AOHX 3196 G**
480	720	167	4 250	8 300	560	630	900	265	**C 30/500 KM**	**AOHX 30/500 G**
	830	264	7 500	12 700	850	530	750	615	**C 31/500 KM**	**AOHX 31/500 G**
	830	325	9 800	17 600	1 140	400	560	775	**C 41/500 K30MB**	**AOH 241/500**
500	780	185	5 100	9 500	640	600	800	355	**C 30/530 KM**	**AOH 30/530**
	870	272	8 800	15 600	1 000	500	670	720	**C 31/530 KM**	**AOH 31/530**
530	820	195	5 600	11 000	720	600	850	415	**C 30/560 KM**	**AOHX 30/560**
	920	280	9 500	17 000	1 100	530	750	855	▶ **C 31/560 KMB**	**AOH 31/560**
570	870	200	6 300	12 200	780	500	700	460	**C 30/600 KM**	**AOHX 30/600**
	980	300	10 200	18 000	1 120	430	600	990	▶ **C 31/600 KMB**	**AOHX 31/600**
600	920	212	6 800	12 900	830	480	670	555	**C 30/630 KM**	**AOH 30/630**
	1 030	315	12 200	22 000	1 370	400	560	1 180	▶ **C 31/630 KMB**	**AOH 31/630**
630	980	230	8 150	16 300	1 000	430	600	705	**C 30/670 KM**	**AOH 30/670**
	1 090	336	12 000	22 000	1 320	380	530	1 410	▶ **C 31/670 KMB**	**AOHX 31/670**
670	1 030	236	8 800	17 300	1 060	450	630	780	**C 30/710 KM**	**AOHX 30/710**
	1 030	315	10 600	21 600	1 290	400	560	1 010	**C 40/710 K30M**	**AOH 240/710 G**
	1 150	345	12 700	24 000	1 430	360	480	1 600	▶ **C 31/710 KMB**	**AOHX 31/710**

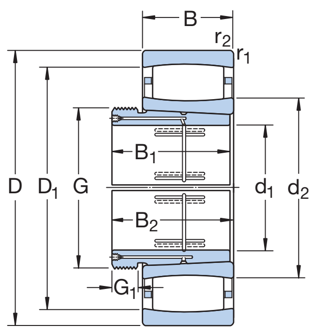
▶ Please check availability of the bearing before incorporating it in a bearing arrangement design

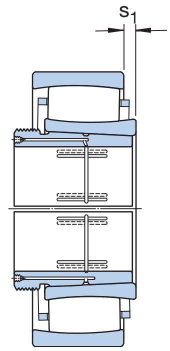


Dimensions									Abutment and fillet dimensions						Calculation factors	
d_1	d_2 ≈	D_1 ≈	B_1	B_2 1)	G	G_1	$r_{1,2}$ min	s_1 2) ≈	d_a 3) min	d_a max	D_a 3) min	D_a max	C_a 4) min	r_a max	k_1	k_2
mm									mm						–	
360	431	511	170	180	Tr 400×5	31	5	27	398	460	495	542	2	4	0,12	0,1
	450	550	232	242	Tr 400×5	36	5	19	400	445	555	600	16,4	4	–	0,106
380	458	553	183	193	Tr 420×5	33	5	30,6	418	480	525	582	2,1	4	0,121	0,099
	485	589	240	250	Tr 420×5	38	6	10,1	426	480	565	624	4,4	5	–	0,109
400	475	570	186	196	Tr 440×5	34	5	32,6	438	510	550	602	2,2	4	0,12	0,1
	508	618	266	276	Tr 440×5	40	6	34,8	446	540	595	674	3,8	5	0,113	0,098
420	491	587	194	205	Tr 460×5	35	6	19,7	463	490	565	627	1,7	5	–	0,105
	514	633	270	281	Tr 460×5	48	6	22	466	510	635	694	19,1	5	–	0,102
440	539	624	202	213	Tr 480×5	37	6	33,5	486	565	605	654	2,3	5	0,114	0,108
	559	679	285	296	Tr 480×6	43	7,5	51	492	570	655	728	4,2	6	0,108	0,105
	540	670	332	355	Tr 480×5	32	7,5	46,2	492	570	655	728	5,6	6	0,111	0,097
460	555	640	205	217	Tr 500×6	38	6	35,5	503	580	625	677	2,3	5	0,113	0,11
	583	700	295	307	Tr 500×6	45	7,5	24	512	580	705	758	20,6	6	–	0,104
480	572	656	209	221	Tr 530×6	40	6	37,5	523	600	640	697	2,3	5	0,113	0,111
	605	738	313	325	Tr 530×6	47	7,5	75,3	532	655	705	798	–	6	0,099	0,116
	598	740	360	383	Tr 530×6	35	7,5	16,3	532	595	705	798	5,9	6	–	0,093
500	601	704	230	242	Tr 560×6	45	6	35,7	553	635	685	757	2,5	5	0,12	0,101
	635	781	325	337	Tr 560×6	53	7,5	44,4	562	680	745	838	4,8	6	0,115	0,097
530	660	761	240	252	Tr 600×6	45	6	45,7	583	695	740	793	2,7	5	0,116	0,106
	664	808	335	347	Tr 600×6	55	7,5	28	592	660	810	888	23,8	6	–	0,111
570	692	805	245	259	Tr 630×6	45	6	35,9	623	725	775	847	2,7	5	0,125	0,098
	710	870	355	369	Tr 630×6	55	7,5	30	632	705	875	948	25,4	6	–	0,105
600	717	840	258	272	Tr 670×6	46	7,5	48,1	658	755	810	892	2,9	6	0,118	0,104
	749	919	375	389	Tr 670×6	60	7,5	31	662	745	920	998	26,8	6	–	0,109
630	775	904	280	294	Tr 710×7	50	7,5	41,1	698	820	875	952	2,9	6	0,121	0,101
	797	963	395	409	Tr 710×7	59	7,5	33	702	795	965	1 058	28	6	–	0,104
670	807	945	286	302	Tr 750×7	50	7,5	47,3	738	850	910	1 002	3,2	6	0,119	0,104
	803	935	360	389	Tr 750×7	45	7,5	51,2	738	840	915	1 002	4,4	6	0,113	0,101
	848	1 012	405	421	Tr 750×7	60	9,5	34	750	845	1 015	1 100	28,6	8	–	0,102

1) Width before sleeve is driven into bearing bore
2) Permissible axial displacement from normal position of one bearing ring in relation to the other (➔ **page 40**)
3) To clear the cage
4) Minimum width of free space for bearings with cage in normal position (➔ **page 18**)

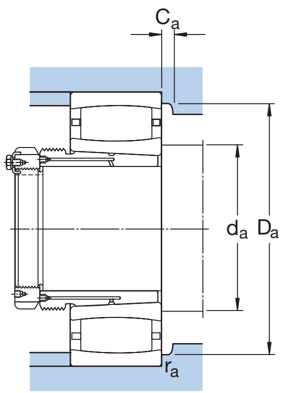
CARB toroidal roller bearings on withdrawal sleeve
d_1 **710 – 950** mm





Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass Bearing + sleeve	Designations Bearing	Withdrawal sleeve
d_1	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
710	1 090	250	9 000	18 000	1 100	380	530	920	▶ **C 30/750 KMB**	**AOH 30/750**
	1 220	365	16 000	30 500	1 800	320	450	1 930	▶ **C 31/750 KMB**	**AOH 31/750**
750	1 150	258	9 150	18 600	1 120	360	480	1 060	▶ **C 30/800 KMB**	**AOH 30/800**
	1 280	375	15 600	30 500	1 760	300	400	2 170	▶ **C 31/800 KMB**	**AOH 31/800**
800	1 220	272	11 200	24 000	1 370	320	430	1 280	▶ **C 30/850 KMB**	**AOH 30/850**
	1 360	400	16 000	32 000	1 830	280	380	2 600	▶ **C 31/850 KMB**	**AOH 31/850**
850	1 280	280	12 700	26 500	1 530	300	400	1 400	**C 30/900 KM**	**AOH 30/900**
900	1 360	300	12 900	27 500	1 560	280	380	1 700	▶ **C 30/950 KMB**	**AOH 30/950**
950	1 420	308	13 400	29 000	1 630	260	340	1 880	▶ **C 30/1000 KMB**	**AOH 30/1000**
	1 580	462	22 800	45 500	2 500	220	300	3 950	▶ **C 31/1000 KMB**	**AOH 31/1000**

▶ Please check availability of the bearing before incorporating it in a bearing arrangement design



Dimensions									Abutment and fillet dimensions						Calculation factors	
d_1	d_2 ≈	D_1 ≈	B_1	B_2[1)]	G	G_1	$r_{1,2}$ min	s_1[2)] ≈	d_a[3)] min	d_a max	D_a[3)] min	D_a max	C_a[4)] min	r_a max	k_1	k_2
mm									mm						–	
710	858	993	300	316	Tr 800×7	50	7,5	25	778	855	995	1 062	21,8	6	–	0,112
	888	1 076	425	441	Tr 800×7	60	9,5	36	790	885	1 080	1 180	31,5	8	–	0,117
750	913	1 047	308	326	Tr 850×7	50	7,5	25	828	910	1 050	1 122	22,3	6	–	0,111
	947	1 133	438	456	Tr 850×7	63	9,5	37	840	945	1 135	1 240	32,1	8	–	0,115
800	968	1 113	325	343	Tr 900×7	53	7,5	27	878	965	1 115	1 192	24,1	6	–	0,124
	1 020	1 200	462	480	Tr 900×7	62	12	40	898	1 015	1 205	1 312	33,5	10	–	0,11
850	1 008	1 172	335	355	Tr 950×8	55	7,5	45,8	928	1 050	1 130	1 252	3,4	6	0,124	0,1
900	1 080	1 240	355	375	Tr 1000×8	55	7,5	30	978	1 075	1 245	1 322	26,2	6	–	0,116
950	1 136	1 294	365	387	Tr 1060×8	57	7,5	30	1 028	1 135	1 295	1 392	26,7	6	–	0,114
	1 179	1 401	525	547	Tr 1060×8	63	12	46	1 048	1 175	1 405	1 532	38,6	10	–	0,105

[1)] Width before sleeve is driven into bearing bore
[2)] Permissible axial displacement from normal position of one bearing ring in relation to the other (➔ **page 40**)
[3)] To clear the cage
[4)] Minimum width of free space for bearings with cage in normal position (➔ **page 18**)

Other associated SKF products

Self-aligning ball bearings

Self-aligning ball bearings as locating bearings are excellent partners for non-locating CARB toroidal roller bearings in self-aligning bearing systems if loads are light and speeds relatively high.

Self-aligning ball bearings were invented in 1907 by Sven Wingquist and SKF was founded to manufacture them. They are the low-friction bearings among rolling bearings and are still the optimum choice for many applications, even today. The SKF range covers all the usual dimension series and sizes for shafts from 5 to 120 mm in diameter. Most sizes are available with a tapered bore as well as a cylindrical bore and can therefore be mounted on the shaft in a variety of ways.

Spherical roller bearings

Spherical roller bearings are used in widely differing branches of industry as the locating bearing in self-aligning arrangements when loads are heavy and speeds moderate. They are used successfully, e.g. in paper machines, for the roller beds of continuous casting plant as well as in ventilators and fans.

Spherical roller bearings are core products for SKF, as are self-aligning ball bearings, and were invented in 1919 by Arvid Palmgren and further developed in three stages by SKF. Today, the range produced by SKF comprises bearings in twelve series in the bore diameter range 20 to 2 300 mm. All are available with cylindrical and tapered bores and some sizes are available in a sealed version.

Accessories

Lock nuts

Lock nuts (also referred to as shaft nuts) are mostly used to axially locate bearings at shaft ends and are produced by SKF in several designs. The KM, KML and HM nuts have four or eight slots equally spaced around the circumference and they are secured by locking washers or locking clips, which engage a groove in the shaft.

KMFE lock nuts with locking screw were specially developed for use with CARB bearings and sealed spherical roller bearings and have dimensions appropriate to these bearings. They can therefore be mounted immediately adjacent to the bearings without impeding axial displacement within the bearing. A holding groove in the shaft is not needed.

KMT precision lock nuts and KMK nuts with locking pin that do not require a groove in the shaft are also available.

Adapter and withdrawal sleeves

Adapter and withdrawal sleeves are used above all for bearing arrangements which have to be repeatedly mounted and dismounted. Bearings with tapered bore can be mounted on smooth shafts as well as stepped shafts. They facilitate bearing mounting and dismounting and often simplify bearing arrangement design.

Adapter sleeves

Adapter sleeves are the more popular as they enable bearings to be mounted on smooth shafts as well as stepped shafts. When using adapter sleeves on smooth shafts it is possible to locate the bearing at any position on the shaft. When used on stepped shafts together with a spacer ring, exact axial positioning of the bearing can be achieved and bearing dismounting is facilitated.

SKF adapter sleeves are slotted and are supplied complete with lock nut and locking device.

Withdrawal sleeves

Withdrawal sleeves can be used to mount bearings with tapered bore on cylindrical seatings of stepped shafts. The sleeve is pressed into the bore of the bearing, which abuts a shaft shoulder or similar fixed component.

SKF withdrawal and adapter sleeves

SKF lock nuts

The sleeve is located on the shaft by a nut or an end plate. SKF withdrawal sleeves are slotted and have an external taper of 1:12 or 1:30.The nuts required for mounting and dismounting the withdrawal sleeve are not supplied with the sleeve and must be ordered separately

Bearing housings

Standard bearing housings together with rolling bearings provide economic bearing arrangements that require little maintenance. This is also true of CARB toroidal roller bearings. Mounted in standard housings the bearings are supported firmly and evenly around their circumference and across the whole raceway width. They are also protected against damp and solid contaminants.

SKF produces a wide variety of bearing housings to meet different application demands. Most are of grey cast iron, but housings of spheroidal graphite cast iron or cast steel can also be produced.

To meet the needs of bearing applications, for example in paper machines, housings to fit the CARB bearings used at the non-drive side are available. These housings can be bolted to the bed as the thermal changes in cylinder length can be accommodated in the CARB toroidal roller bearing itself.

See also SKF catalogues
– "Bearing accessories"
– "Bearing housings"

and SKF brochures
– 4403 "SNL plummer block housings solve the housing problems"
– 4410 "The CARB bearing – a better solution for the front side of drying cylinders"
– 5100 "SKF spherical roller bearings – setting a new standard for performance and reliability"
– 5101 "SNL 30 and SNL 31 plummer block housings solve the housing problems"

or the
– "SKF Interactive Engineering Catalogue" on CD-ROM or online at www.skf.com

Lubricants and lubrication equipment

CARB toroidal roller bearings operate under the most varying loads, speeds, temperature and environmental conditions. They require the type of high-quality lubricating greases, which SKF provides.

SKF greases have been specially developed for rolling bearings in their typical applications. The SKF range includes fifteen environmentally friendly greases and covers practically all application requirements.

The range is complemented by a selection of lubrication accessories including

- automatic lubricators,
- grease guns,
- lubricant metering devices and
- a wide range of manually and pneumatically operated grease pumps.

Products for mounting and dismounting

Like all rolling bearings, CARB toroidal roller bearings require a high degree of skill when mounting or dismounting, as well as the correct tools and methods.

The comprehensive SKF range of tools and equipment includes everything that is required:

- mechanical tools,
- heaters,
- hydraulic tools and equipment,
- pullers and withdrawal tools for all sizes of bearings.

Induction heater, hydraulic pumps, hydraulic nut, mounting fluid and anti-fretting paste from SKF

See also catalogue MP3000 "SKF Maintenance and Lubrication Products" or online at www.mapro.skf.com

SKF lubricants: always the best choice for any kind of bearing application

Condition monitoring equipment

The goal of condition monitoring is to maximise the time that the machine is functioning well and minimize the number of breakdowns, thereby significantly reducing operating downtime and maintenance costs.

To achieve this, it is recommended that the bearing and machine condition be monitored either periodically or continuously. Condition monitoring enables incipient bearing damage to be detected and evaluated, so that bearing replacement can be scheduled for a time when the machine is not in operation, to avoid unplanned stoppages. Applied to all machinery (not just sensitive or problematic machines), condition monitoring improves machinery operation to an optimum level, often exceeding the original equipment specifications.

SKF provides a comprehensive range of condition monitoring equipment to measure all important parameters. These include

- temperature,
- speed,
- noise,
- oil condition,
- shaft alignment,
- vibration and
- bearing condition.

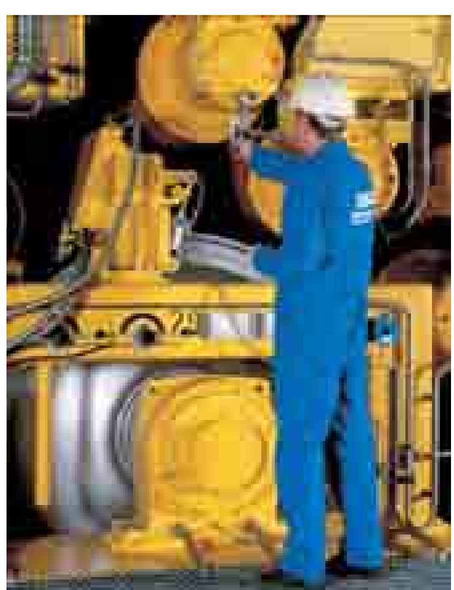
The range includes lightweight, hand-held devices for manual use as well as complex continuous monitoring systems for fixed installations in connection with preventive maintenance.

One example is the Machine Reliability Inspection System MARLIN™, which is at the leading edge of technology and allows storage of up to 2 000 measuring points. It can be used to diagnose machines and individual bearings and is backed by tailored software for the evaluation of the readings including enveloping vibration acceleration curves.

Recording vibration values using an SKF Microlog data collection unit

Taking the temperature

Noise testing



The MARLIN™ machine reliability inspection system

SKF – The knowledge engineering company

The business of the SKF Group consists of the design, manufacture and marketing of the world's leading brand of rolling bearings, with a global leadership position in complementary products such as radial seals. SKF also holds an increasingly important position in the market for linear motion products, high precision aerospace bearings, machine tool spindles, as well as plant maintenance services and is an established producer of high-quality bearing steel.

The SKF Group maintains specialized businesses to meet the needs of the global marketplace. SKF supports specific market segments with ongoing research and development efforts that have led to a growing number of innovations, new standards and new products.

SKF Group has global ISO 14001 environmental certification. Individual divisions have been approved for quality certification in accordance with either ISO 9000 or appropriate industry specific standards.

Some 80 manufacturing sites worldwide and sales companies in 70 countries make SKF a truly international corporation. In addition, our 7 000 distributor and dealer partners around the world, e-business marketplace and global distribution system put SKF close to customers for the supply of both products and services. In essence, SKF solutions are available wherever and whenever our customers need them.

Overall, the SKF brand now stands for more than ever before. It stands for the knowledge engineering company ready to serve you with world-class product competences, intellectual resources and the vision to help you succeed.

Harnessing wind power
The growing industry of wind-generated electric power provides an environmentally compatible source of electricity. SKF is working closely with global industry leaders to develop efficient and trouble-free turbines, using SKF knowledge to provide highly specialized bearings and condition monitoring systems to extend equipment life in the extreme and often remote environments of wind farms.

Developing a cleaner cleaner
The electric motor and its bearings are the heart of many household appliances. SKF works closely with appliance manufacturers to improve their product performance, cut costs and reduce weight. A recent

example produced a new generation of vacuum cleaners with substantially more suction. SKF's knowledge in small bearing technology is also applied to manufacturers of power tools and office equipment.

Delivering asset efficiency optimization
To optimize efficiency and boost productivity, many industrial facilities outsource some or all of their maintenance services to SKF, often with guaranteed performance contracts. Through the specialized capabilities and knowledge available from SKF Reliability Systems, SKF provides a comprehensive range of asset efficiency services, from maintenance strategies and engineering assistance, to operator-driven reliability and machine maintenance programs.

Creating a new "cold remedy"
In the frigid winters of northern China, sub-zero temperatures can cause rail car wheel assemblies and their bearings to seize due to lubrication starvation. SKF created a new family of synthetic lubricants formulated to retain their lubrication viscosity even at these extreme bearing temperatures. SKF's knowledge of lubricants and friction are unmatched throughout the world.

Evolving by-wire technology
SKF has unique expertise and knowledge in fast growing by-wire technology, from fly-by-wire, to drive-by-wire, to work-by-wire. SKF pioneered practical fly-by-wire technology and is a close working partner with all aerospace industry leaders. As an example, virtually all aircraft of the Airbus design use SKF by-wire systems for cockpit flight control. SKF is also a leader in automotive drive-by-wire, having jointly developed the revolutionary Filo and Novanta concept cars which employ SKF mechatronics for steering and braking. Further by-wire development has led SKF to produce an all-electric forklift truck which uses mechatronics rather than hydraulics for all controls.

Planning for sustainable growth
By their very nature, bearings make a positive contribution to the natural environment. Reduced friction enables machinery to operate more efficiently, consume less power and require less lubrication. SKF is continually raising the performance bar, enabling new generations of high-efficiency products and equipment. With an eye to the future, SKF's global policies and manufacturing techniques are planned and implemented to help protect and preserve the earth's limited natural resources. We remain committed to sustainable, environmentally responsible growth.

Maintaining a 320 km/h R&D lab
In addition to SKF's renowned research and development facilities in Europe and the United States, Formula One car racing provides a unique environment for SKF to push the limits of bearing technology. For over 50 years, SKF products, engineering and knowledge have helped make Scuderia Ferrari a formidable force in F1 racing. (The average racing Ferrari utilizes more than 150 SKF components.) Lessons learned here are applied to the products we provide to automakers and the aftermarket worldwide.

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