

## CARB™ toroidal roller bearings can improve the performance and reliability of bearing arrangements

CARB is the first toroidal roller bearing. (The name toroidal refers to the form of the raceways.) This new design offers a roller bearing with unique features.

It is self-aligning and can accommodate unavoidable *shaft misalignment* without any reduction of the service life. CARB is a truly radial bearing and *axial displacement* of the shaft can take place inside the bearing at very low friction and negligible thrust loads. The high radial *load carrying capacity* increases the reliability of arrangements with CARB.

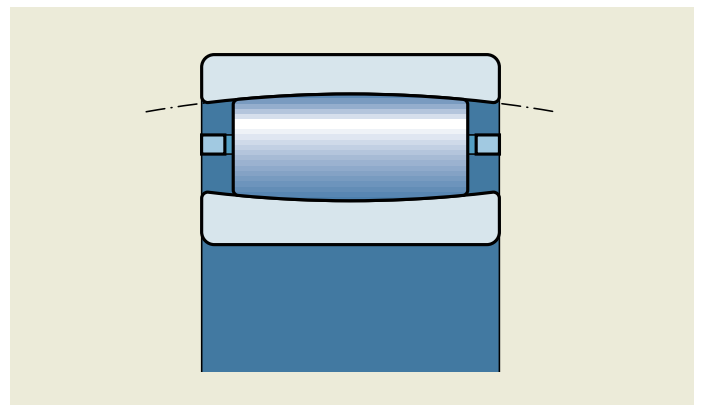
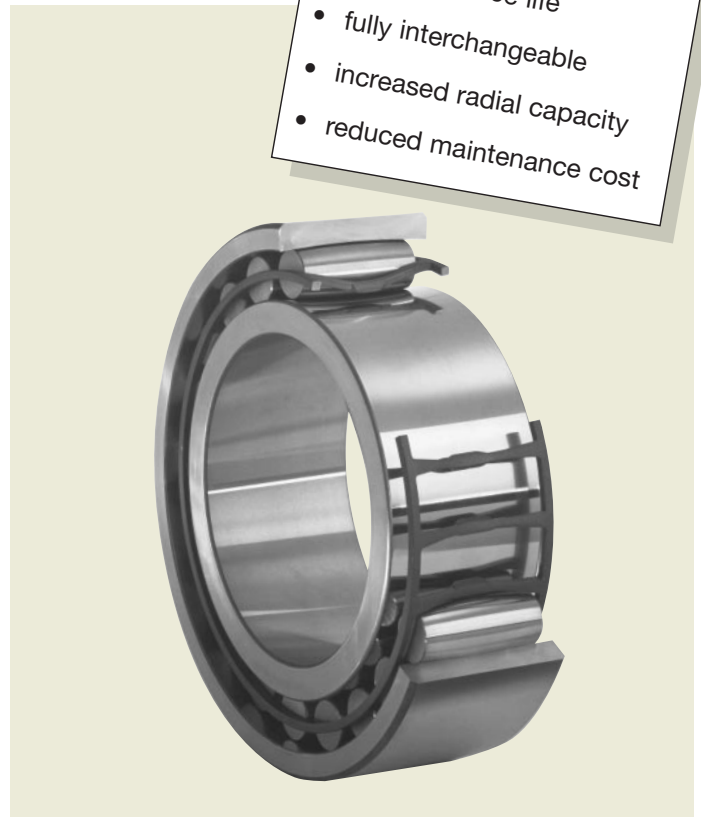
CARB toroidal roller bearings are interchangeable with self-aligning ball bearings, spherical roller bearings, cylindrical roller bearings and needle roller bearings in a non-located position.

### Design

CARB toroidal roller bearings have one row of rollers and are available with cylindrical and tapered bore with cages or as full complement roller bearings. The large radius of the rollers and raceways enable CARB to be self-aligning and axially free. Full complement CARB bearings offer even higher radial load carrying capacity and are suitable when the speed is relatively low.

The rings and rollers are made from SKF's own high quality rolling bearing steel. Bainite heat treatment ensures outstanding toughness of the rings. Case hardened rings are optional. Smaller sizes have cages made of reinforced polyamide and larger sizes have steel cages. CARB is temperature stabilized to 200 °C.

- Advantages with CARB™**
- longer service life
  - fully interchangeable
  - increased radial capacity
  - reduced maintenance cost



# Load distribution

The rollers which are self-adjusting for both misalignment and axial displacement, automatically position themselves in such a way that the load is evenly distributed over the roller length.

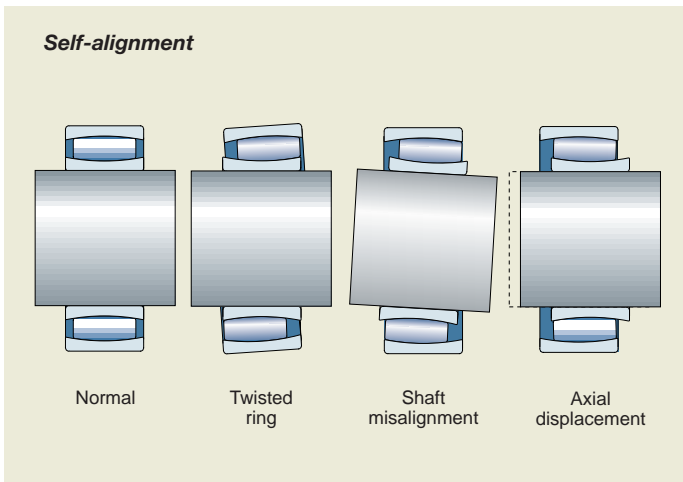
# Misalignment

During operation, when the shaft and housings are loaded, the shaft will bend and the housings will be slightly deformed, causing the shaft to become misaligned in relation to the housings.

Normally this misalignment is very small but even slight misalignment will reduce the life of rigid bearings whilst the life of a toroidal roller bearing will be unaffected at misalignment angles up to 0,5°.

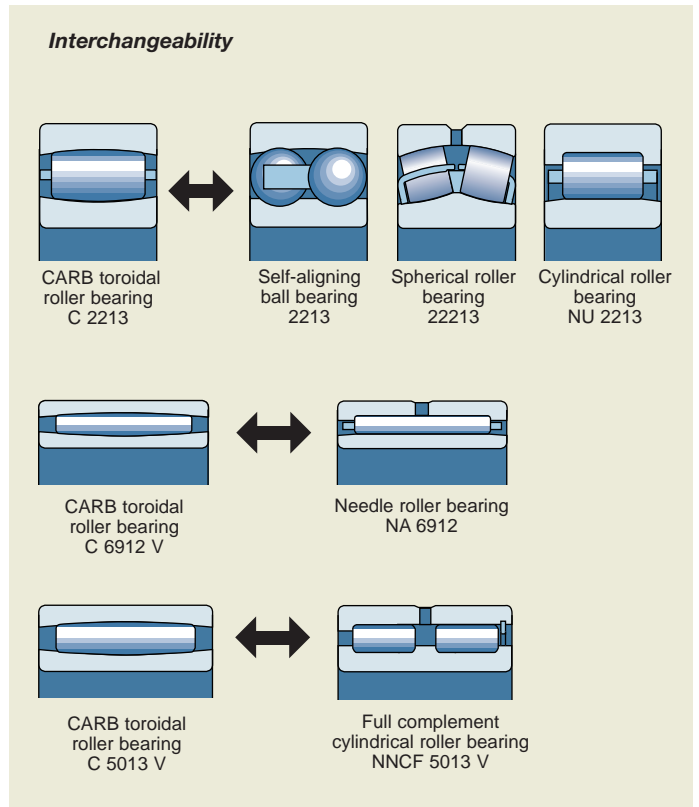
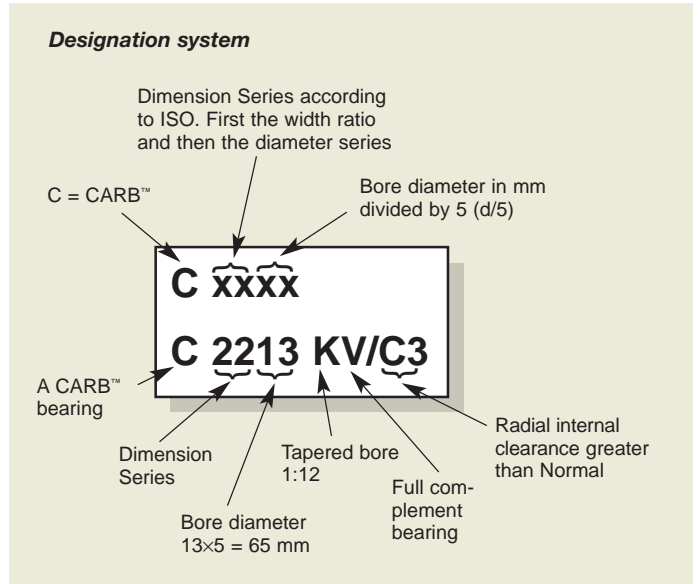
# Axial displacement

At normal operating clearance the permitted axial displacement can be up to ±10 % of the bearing width. Initial axial displacement of one ring in relation to the other can be used to increase the available axial clearance for shaft movement in the opposite direction.



# Designation

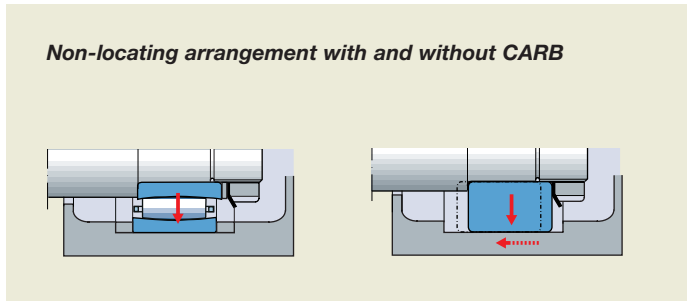
The designation system of CARB toroidal roller bearings is according to ISO, thus simplifying the task of using CARB to replace other bearings.



# Main purpose of CARB

The CARB toroidal roller bearing is basically a radial bearing and does not accommodate any thrust load. This makes it ideal for the non locating position in most bearing arrangements. The non locating bearing must be axially free to cope with axial movements, for example due to changes in shaft length caused by temperature variations.

In a conventional bearing arrangement this takes place between the outer ring and housing. Increased friction and fretting corrosion will sometimes impede the ring from moving freely. If this occurs, the bearings can be subjected to heavy internal thrust loads which reduce the life and increase the temperature, vibration and noise. These disadvantages are avoided completely with CARB which accommodates the axial displacement of the shaft inside the bearing under very low friction and negligible thrust loads.



## Bearing arrangement

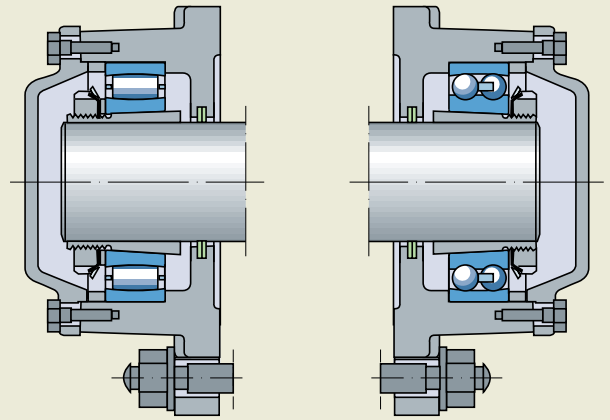
A bearing arrangement with a self-aligning ball bearing in the locating position and a toroidal roller bearing as non-locating bearing offers many advantages. The bearings are self-aligning which takes care of any shaft misalignment without negative influences on the bearing service life.

CARB allows the shaft to move smoothly without inducing internal thrust loads and both inner and outer rings can be mounted with an interference fit, so the problems associated with a loose outer ring, such as fretting corrosion, distortion of the ring will be avoided. This arrangement has been described by one of our customers as “The safe solution without compromise.”

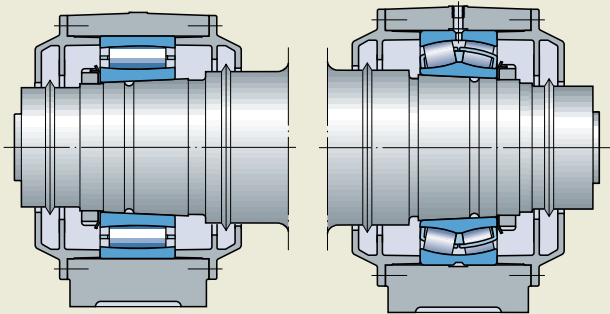
### Advantages with CARB

- longer service life
- reduced maintenance cost
- interchangeability with self-aligning ball bearings, spherical, cylindrical and needle roller bearings
- elimination of rotating outer rings and worn bearing seatings
- lower vibration level
- reduced noise

**CARB toroidal roller bearing as non-locating bearing and a self-aligning ball bearing as locating bearing**



**CARB toroidal roller bearing as non-locating bearing and a spherical roller bearing as locating bearing**



## How CARB is used

Mounting and lubrication of CARB are carried out in the same manner as for other bearings. This means that the same methods and tools should be used. As axial movement takes place inside the bearing the outer ring must be supported axially e.g. with locating rings.

Lubrication should be arranged so the lubricant passes through the bearing, in the same way as for instance cylindrical roller bearings.

In spite of the short time CARB has been on the market the list of references is impressive. Here are some examples.

### Reported experiences

- longer service life in planetary gear
- lower operating temperature in sugar cane shredders and cane knife
- elimination of rotating outer rings and worn bearing seatings in hot gas fans
- longer service life in continuous casting machines
- increased machine availability and reduced maintenance cost for yankee cylinder
- reduced vibration level and less maintenance for drying cylinders
- better wheel guiding in crane wheels
- lower noise and vibration in industrial transmissions
- reduced noise and operating temperature in centrifugal pumps
- simplified design of steel mill guide rolls
- shorter mounting time in textile machines
- longer service life in conveyor support rolls

### Most reported benefits

- reduced maintenance cost
- longer service life
- lower operating temperature
- lower vibration level

### Reference list

Gearbox, output shaft	Benzler AB, Sweden
Hot gas fan, sugar mill	Howden Fan Co., Australia
Hot gas fan, sugar mill	Prosperine Sugar mill, Australia
Hot gas fan, power plant	Uppsala Energi, Sweden
Hot gas fan, paper mill	Kimberly Clark SNC, France
Shredder, sugar mill	TSB Malclane mill, South Africa
Shredder, sugar mill	CSR Sugar Inkerman mill, Australia
Shredder, sugar mill	Tongaat-Hulett Darnall mill, South Africa
Cane knife, sugar mill	Tongaat-Hulett Darnall mill, South Africa
Yankee cylinder	AssiDomän paper mill, Sweden
Drying cylinder	Braviken paper mill, Sweden
Drying cylinder	Ortviken paper mill, Sweden
Drying cylinder	KNP LEYKAM, Netherlands
Drying cylinder	Hansol Paper, Korea
Continuous casting	SIDMAR N.V., Belgium
Crane wheel	Huisman-Itrec, Netherlands