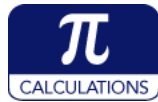
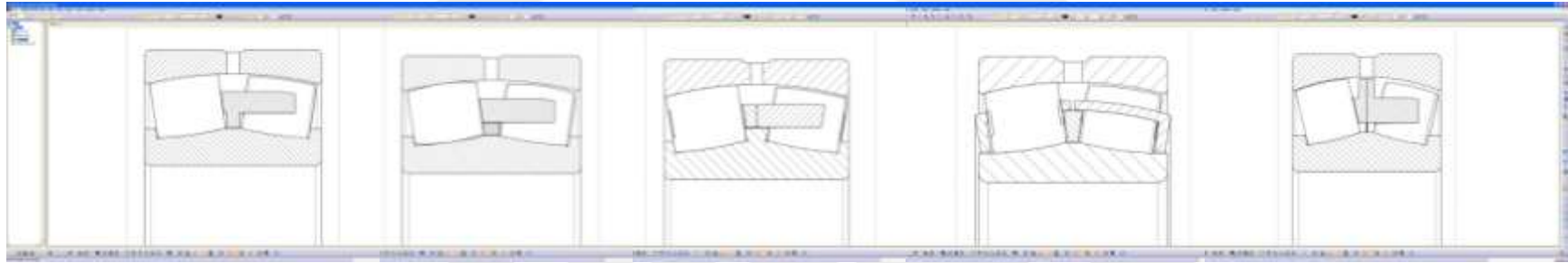


# **RKB spherical roller bearings: executions and applications**



# RKB spherical roller bearings: endowed with the latest technology



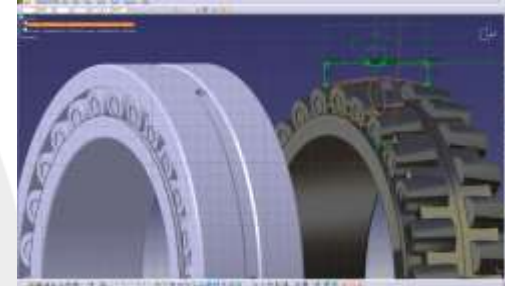
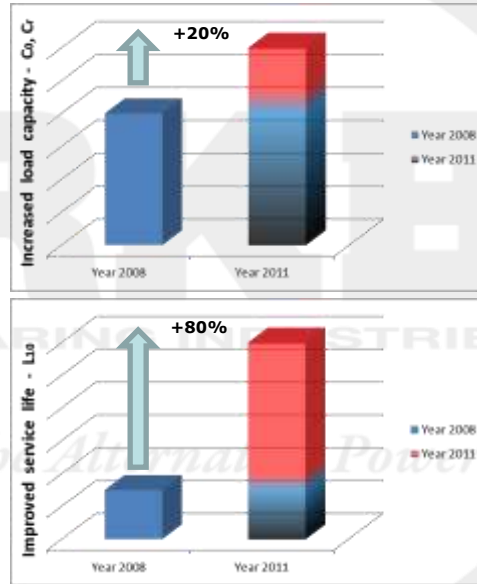
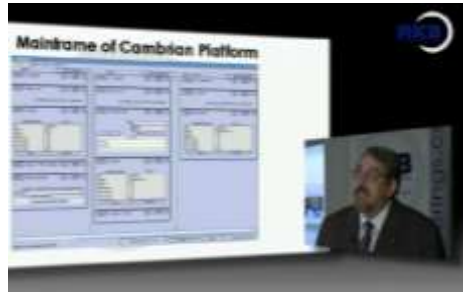
RKB spherical roller bearings are produced with the latest technology available:

- advanced calculation and simulation tools for continuous improvement of inner design and geometry
- special bearing steel for premium reliability
- special treatments for rings and rollers to meet application requirements
- special CNC machined raceways and rollers surface finishing for proper roughness, elastohydrodynamic lubrication (EHL) and film thickness
- CNC machined brass cage for uniform running and even load distribution

The latest technology ensures:

- precision, accuracy and long time performance
- suitability for standard and special industrial applications in severe and critical conditions

# RKB spherical roller bearings: continuous improvements



Improved load capacities and service life due to:

- high quality steel and treatments
- latest manufacturing machinery and inspection procedures
- internal geometry optimization via a new two-phase evolutionary algorithm
- calculation software systems, FEM analysis and test protocols

# RKB spherical roller bearings: continuous improvements



RKB constantly uses the most modern technology to properly evaluate the performance of every new product.

The test rig center in RKB T3 Plant was recently enlarged with the installation of the new ABLT 5A, a rapid bearing life and reliability evaluation tool that solves problems connected to accelerated automatic rolling bearing fatigue life and reliability and fast failure analysis system technology.

# RKB heat treatments



RKB Bearing Industries can perform two special heat treatments on its products: the RKB Bainite Treatment (HB) and the RKB Dimensional Stabilization Treatment (S).

Depending on application requirements, these treatments can be applied independently or together, on one or both bearing rings. The benefits offered by the RKB Bainite Treatment to our bearings are related to: the high ductility level, high impact, wear and fatigue resistance, high and uniform hardness and low incidence of cracking.

(for further information refer to the related educational video “RKB Special Heat Treatments for Heavy Duty Applications”).

# RKB thermo-chemical treatments

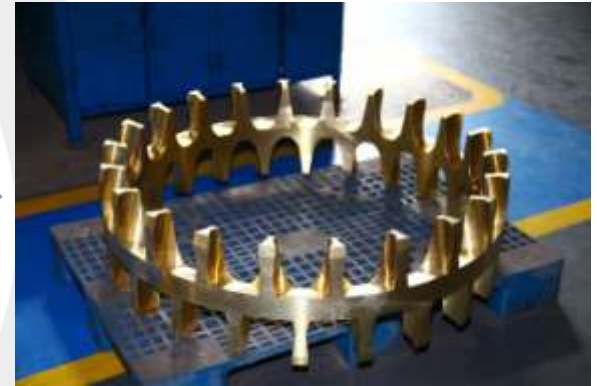
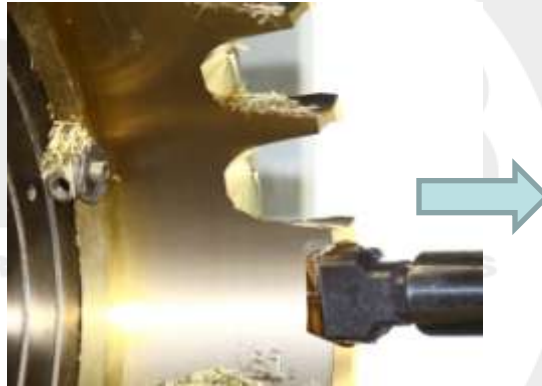


Thanks to these treatments, the metal-to-metal friction between the contact surfaces of the bearing components is reduced. In this way, we diminish the risk of premature bearing failure and extend bearing service life.

The benefits offered by the RKB Anti-Wear Treatment to our bearings are related to: improved roughness, reduced coefficient of friction, high wear resistance, high fatigue strength, unchanged dimensions, form, hardness and metallurgical structure of the material.

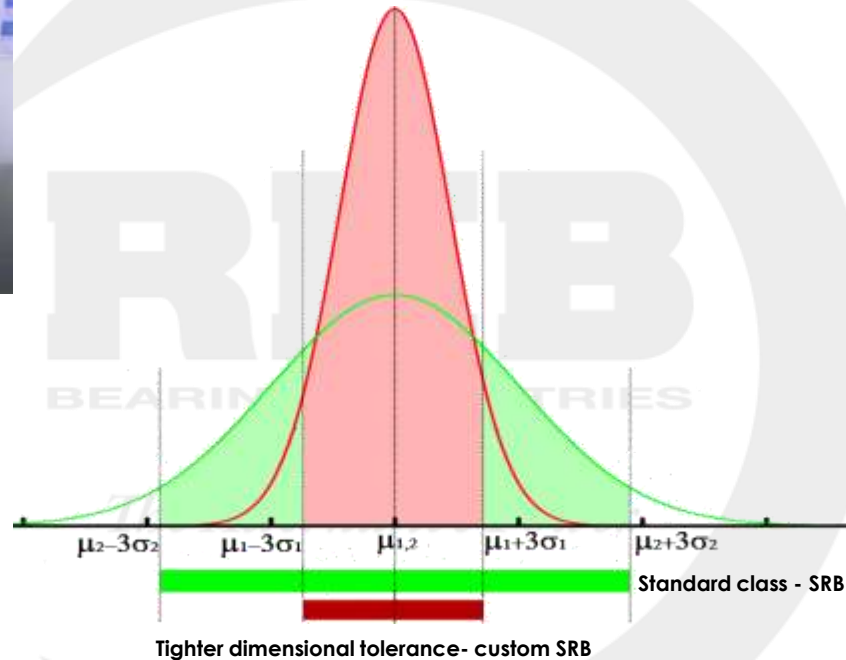
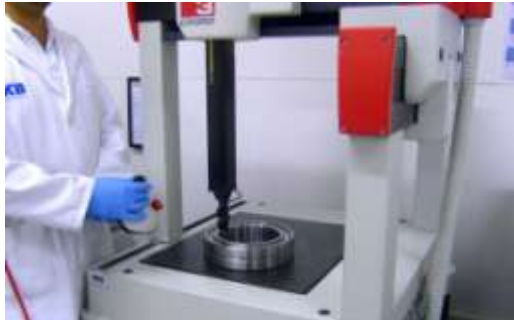
(for further information refer to the related educational video “RKB Anti-Wear Technology (AWT) for Extended Service Life”).

# RKB CNC brass cages



The cage reduces the friction at high speeds, through the self-lubricating properties of its material. Because of the inertia forces, frictional contact and strain, cages are subjected to mechanical stress and chemical action of certain lubricants or additives. For this reason, the design and materials are the key elements to the performance of bearings. The RKB brass cages are machined with modern CNC centers that ensure top quality output products with improved designs that meet customer requirements. The manufacturing technology cuts down development time and therefore total costs.

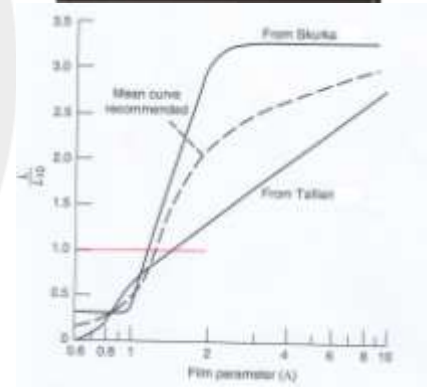
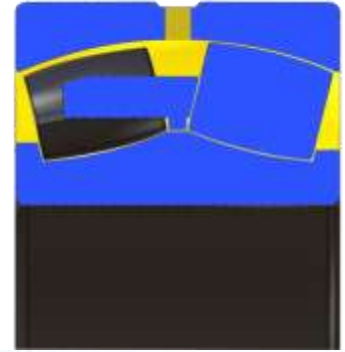
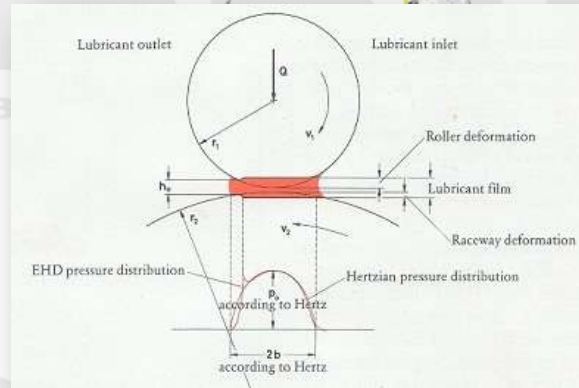
# RKB precision and performance



The RKB dimensional, surface and form parameters are daily checked by a continuous dimensional inspection aiming at quality assurance of our finished products and manufacturing processes.

RKB spherical roller bearings are also available with reduced and increased internal clearances (C2, C3, C4 and so on), with cylindrical or taper bore. Besides, there are special executions for specific applications such as wire and rod mills in the steel industry or sealed type, identified by the suffix 2CZ, for harsh environments.

# RKB CNC superfinishing



In order to improve bearing quality by reducing surface waviness on raceways, RKB makes use of superfinishing CNC machines to produce a quieter and smoother functioning along with the bearing assembly. The roughness parameter is also very well connected to bearing rating life through EHL film formation. The EHL film thickness is often found to be in the range of  $0.2 - 0.4 \mu\text{m}$  which is similar to the surface roughness of ground surfaces. If the film parameter  $\lambda \geq 4$  (based on RKB software for rating life calculations), the fatigue life can be expected to exceed standard  $L_{10}$  estimates by at least 100%.

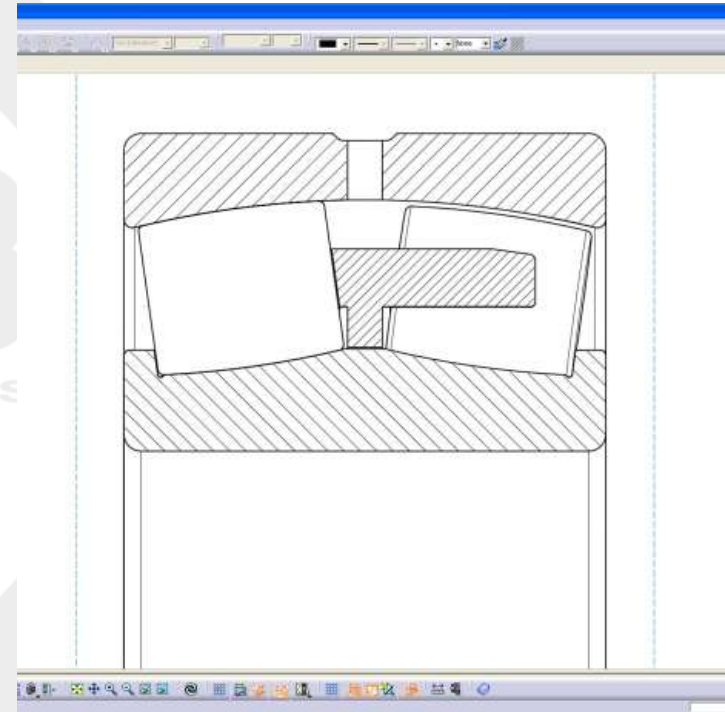
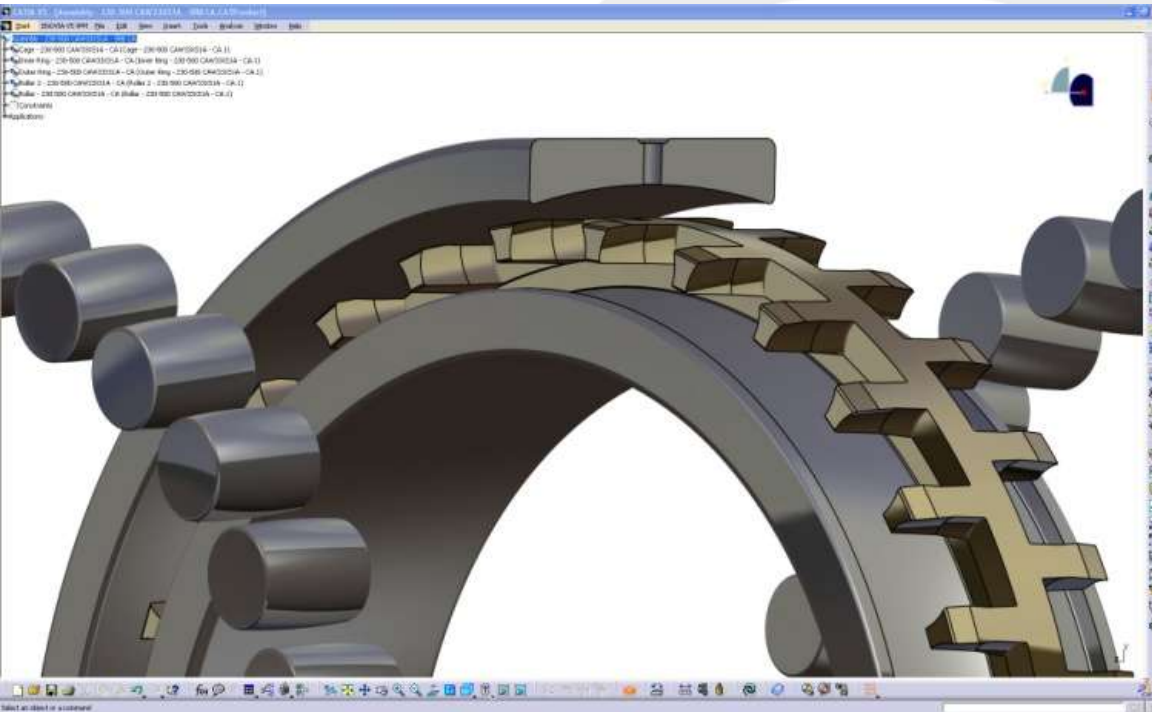
# RKB spherical roller bearings types



The ISO-compliant spherical roller bearings produced by RKB cover most of the requirements in various standard and special industrial applications, in severe or critical conditions. We specialize in providing adequate technical solutions by selecting the proper bearings according to our experienced engineers and proprietary in-house developed software systems for advanced calculations and evaluation.

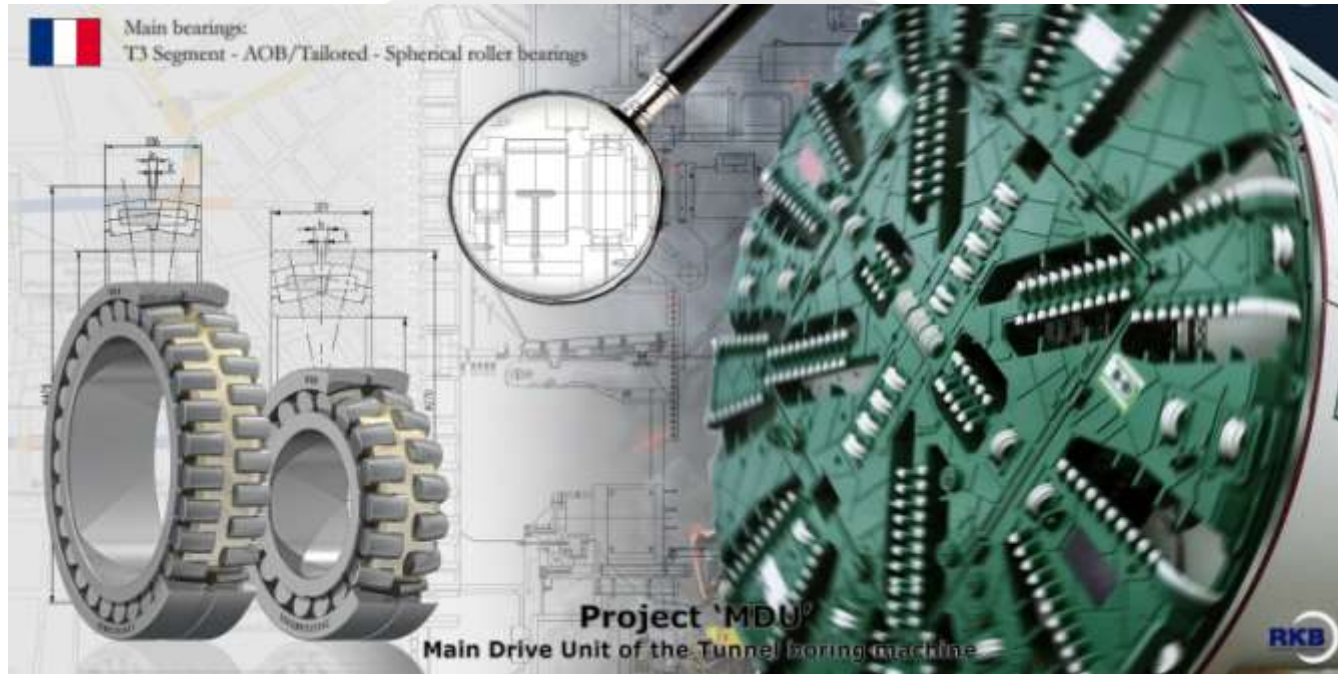
RKB spherical roller bearings are interchangeable, meaning that each configuration can be successfully replaced by any other, offering anyway good running performances in standard applications.

# RKB CA design and applications



**Bearing with symmetrical rollers and retaining ribs. The cage is a one-piece, double pronged machined cage of brass**

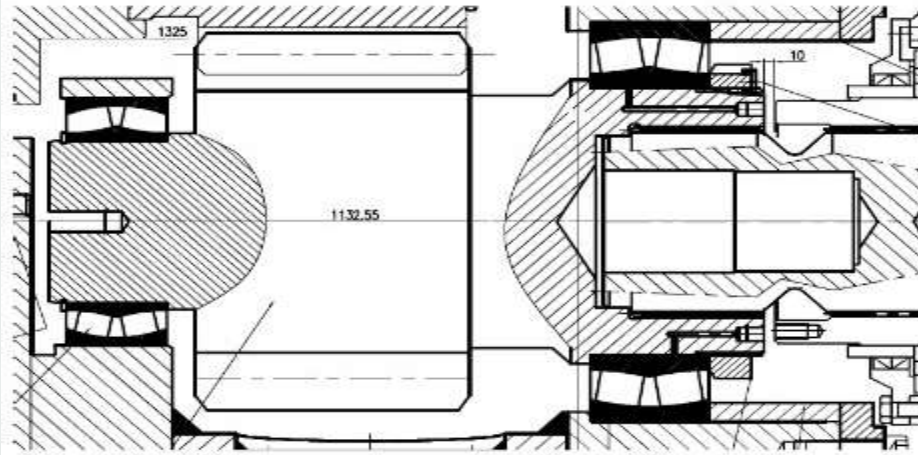
# RKB CA design and applications



In special industrial applications (tunnel boring machines – TBM, drilling units etc.), bearings are subjected to variable working conditions with high vibrations, shock loads and contaminants. RKB CA design is conceived and manufactured to provide reliability in such conditions.

CA design is used for large bore bearings, supporting high radial loads and moderate axial loads. The cage design offers improved strength to guide the heavy rollers through the accelerations and decelerations experienced when entering and exiting the loaded zone.

# RKB CA design and applications

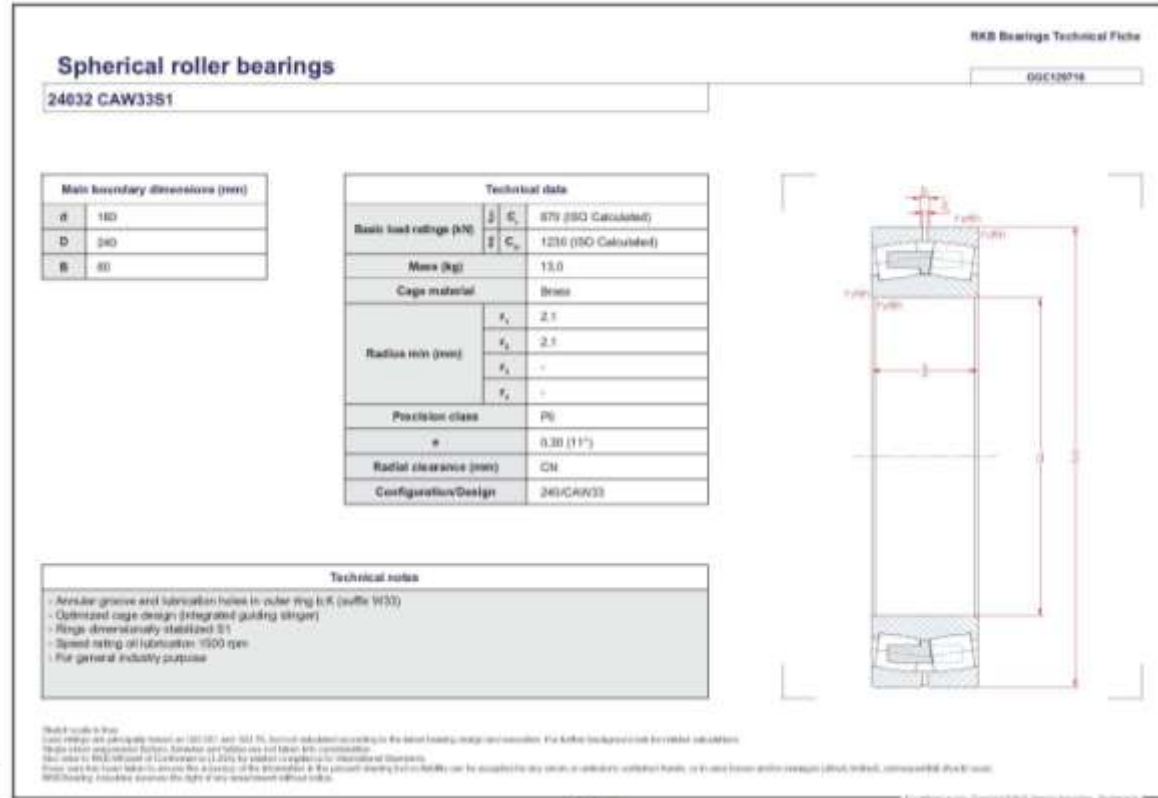


The TBM comprises a main drive, intended to give rotational power to the cutter head. The main drive consists of the electric motor, the gearbox, and a clutch (torque) coupling assembly. In order for the cutting head to follow in a circular path, a significant amount of force is necessary to drive the bit along the solicited path. A large torque is required to move the arm, as the basic function of the TBM is to excavate in hard rock. The thrust force is a variable parameter and it should be adjustable or controllable. As a result, the drive has to move the arm in a circular path.

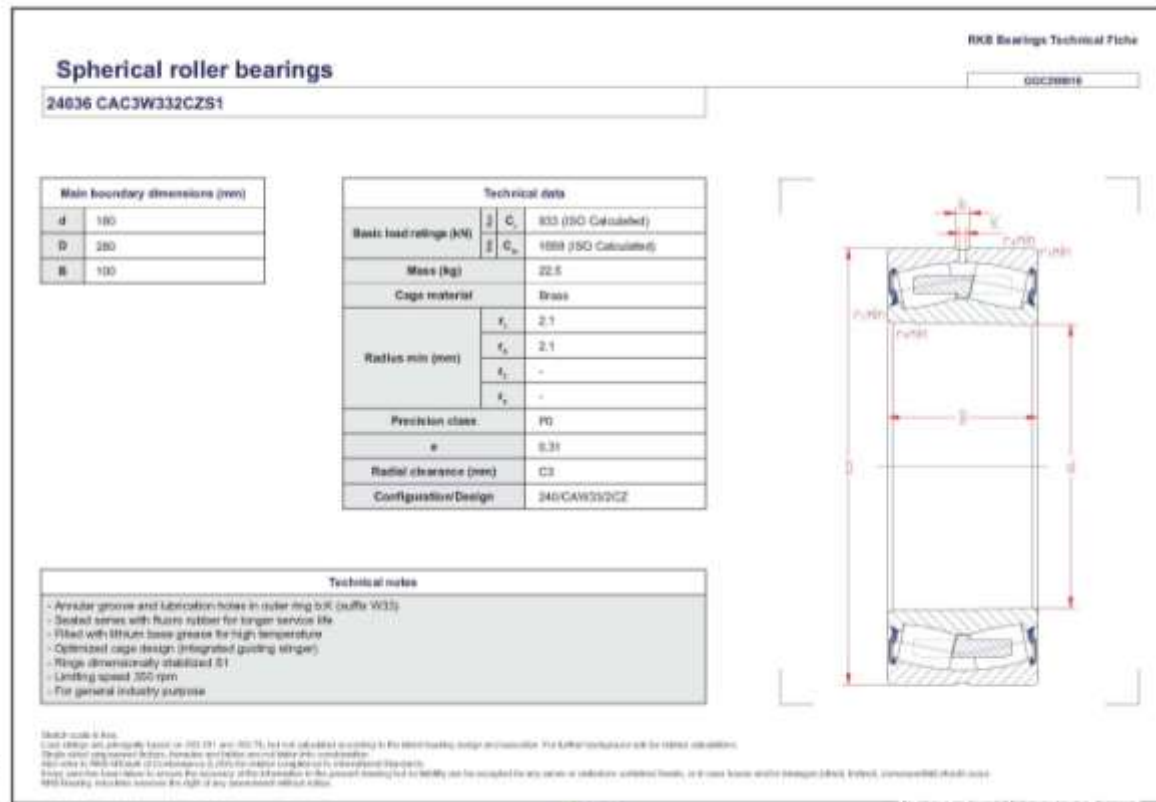
Heavy radial loads, moderate/high torque and variable thrust forces are the application typical features that the bearings intended for the main drive unit of the TBM must withstand.

RKB spherical roller bearings are self-aligning and consequently insensitive to the misalignment of the shaft relative to the housing and insensitive to shaft deflection or bending. In addition to high radial loads, RKB spherical roller bearings can accommodate axial loads acting in both directions.

# RKB CA design: example of Technical Fiche

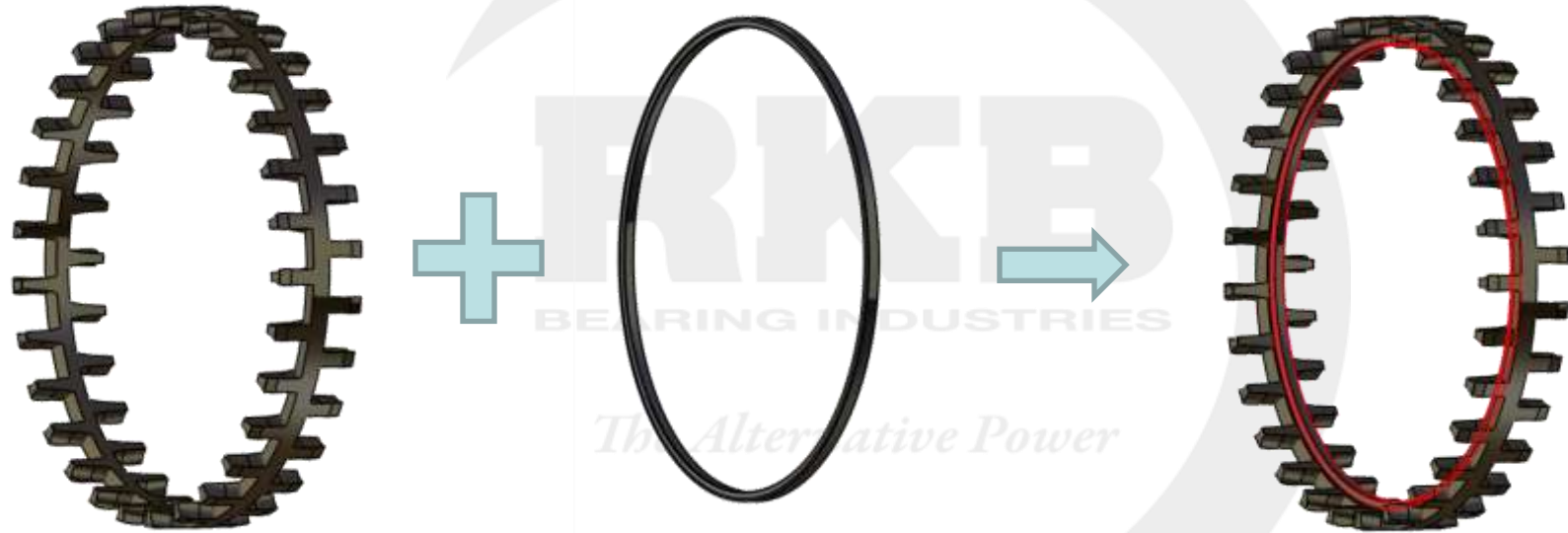


# RKB CA design (sealed series): example of Technical Fiche





# RKB ECA design and applications

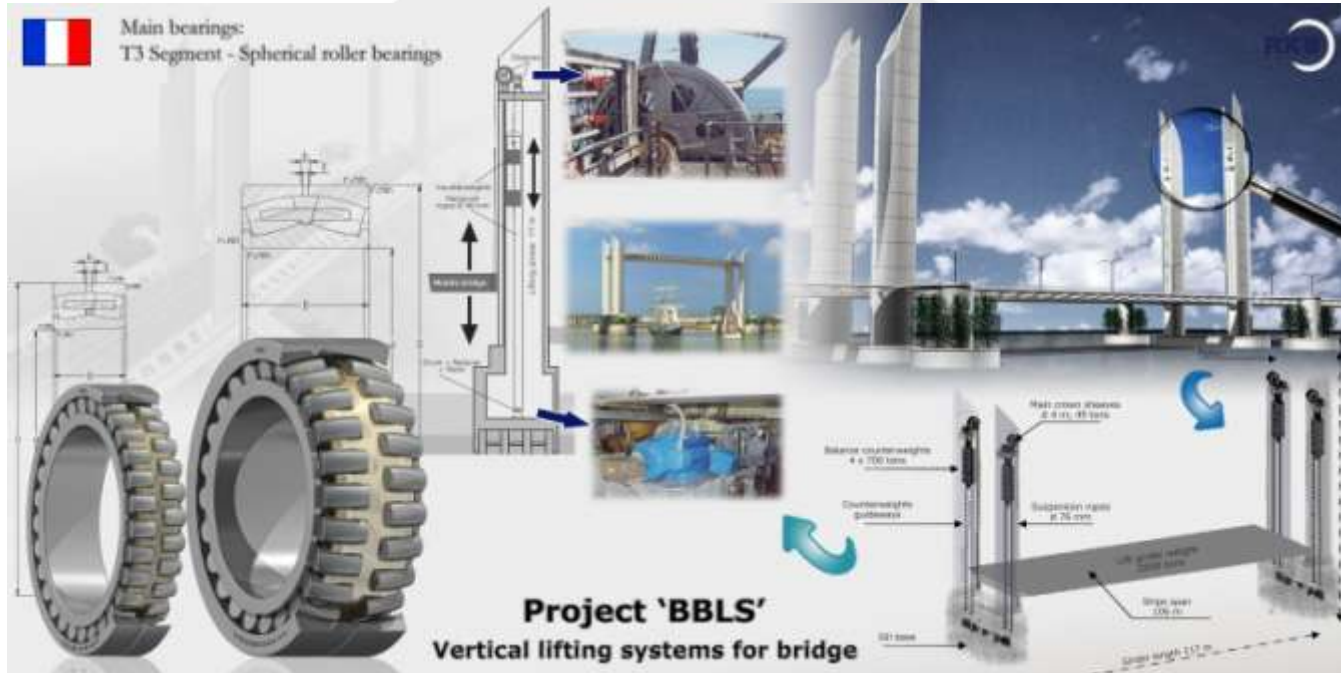


- One-piece machined brass
- Double-pronged cage

- Guiding slinger
- Centered on the inner ring

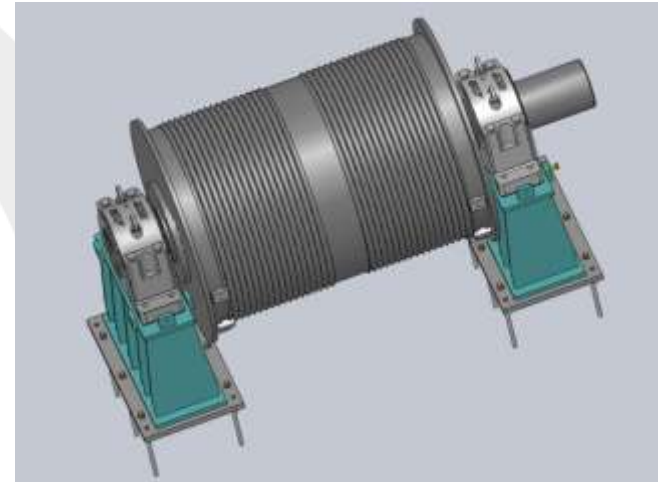
- Suitable for high acceleration/deceleration demands
- Smooth performance of the rollers on the raceways
- Proper lubrication and guidance on the inner ring
- Shock absorbing

# RKB ECA design and applications



The ECA design incorporates the CA design having reinforced roller sets for higher load carrying capacity. This series has been developed through advanced analysis techniques and application evaluation tests. The ECA bearings are subject to fewer restrictions on operating temperature and lubricant type. ECA represents a solution first developed and produced by RKB to satisfy the high reliability requirements of the application and withstand the extra loads generated by the system in case of bridge blocking caused by an overtorque in the lifting system.

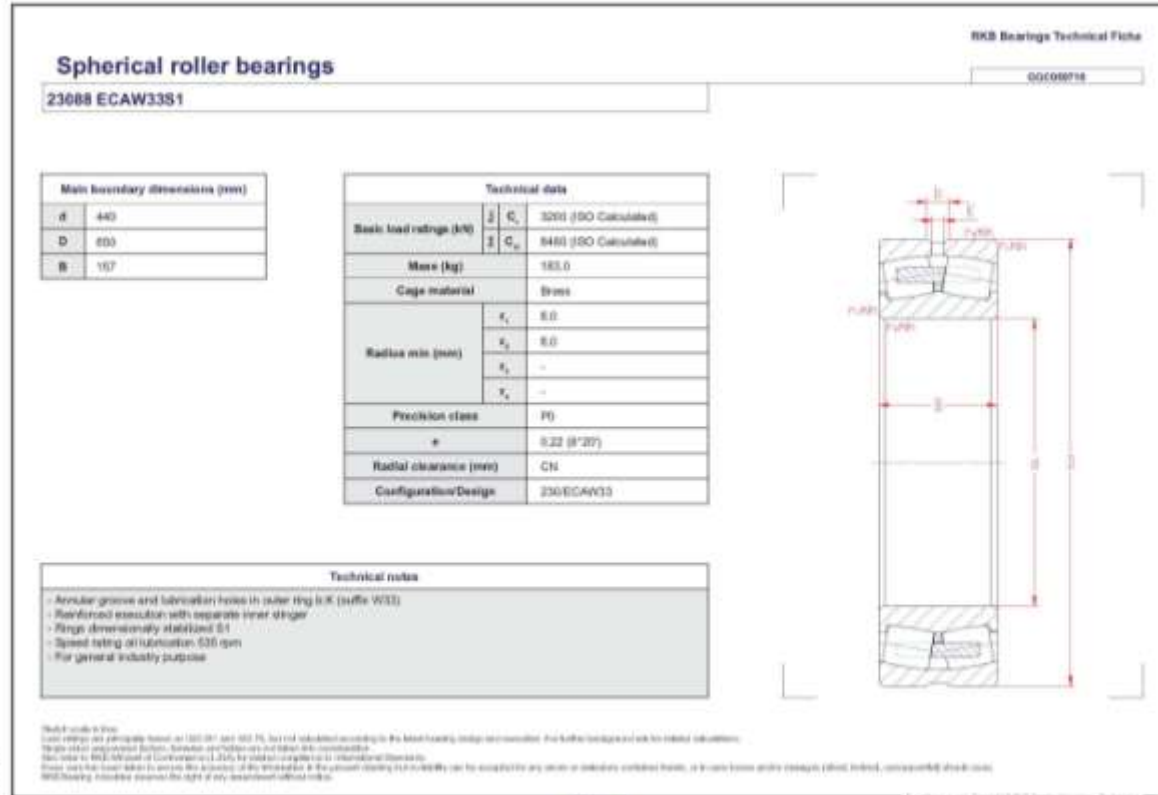
Technical drawing of a mechanical assembly in cross-section. The drawing shows a central shaft with a diameter of  $\varnothing 55.4$  mm, supported by bearings. The total length of the assembly is 1680 mm. Key dimensions include: 1280 mm for the main body length, 270 mm for the bearing housing width, 125 mm for the bearing housing thickness, and 80 mm for the bearing housing height. The drawing also shows a 90-degree angle on the left side and a 15-degree angle on the right side. The assembly is shown in a cross-section view, with hatching used to indicate different materials.



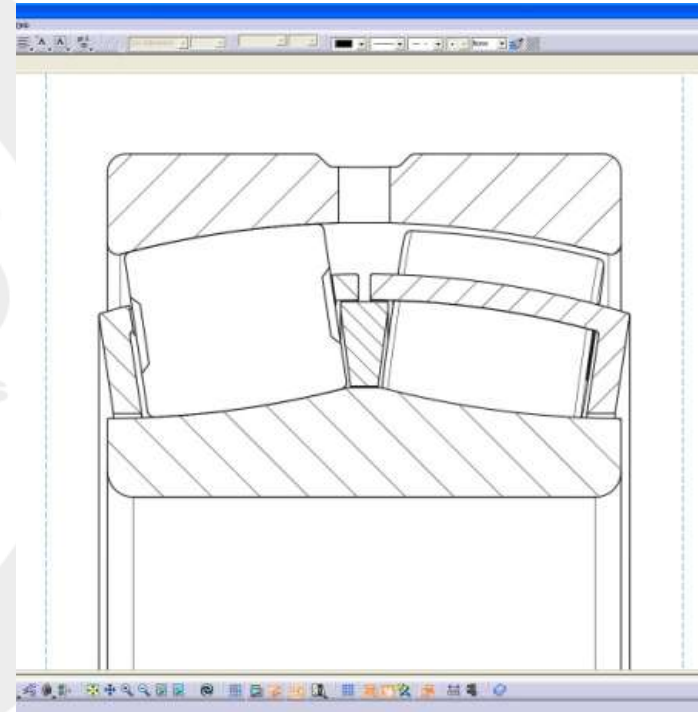
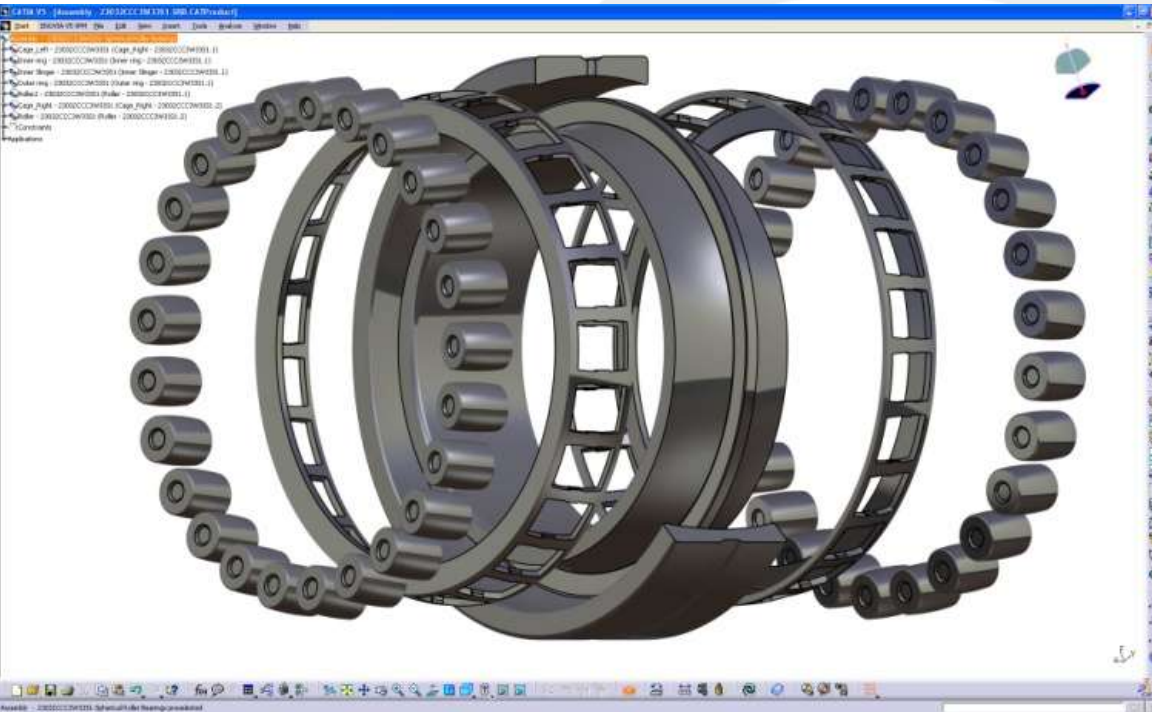
To withstand the harsh working conditions (high levels of shocks, wear and fatigue), the bearing is subjected to two special heat treatments: the RKB Bainite Treatment (HB) and the RKB Dimensional Stabilization Treatment (S).

Because of the low rotational speed, the bearing is provided with adequate roughness surface in order to ensure the elastohydrodynamic lubrication (EHL) film thickness that leads to an increased bearing life.

# RKB ECA design: example of Technical Fiche



# RKB CC design and applications



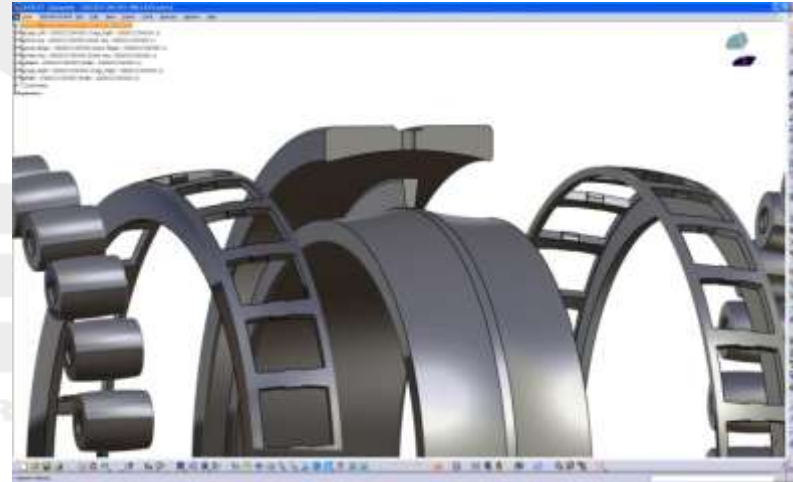
**Bearing with symmetrical rollers, flangeless inner ring, a non-integral guide ring between the two rows of rollers centred on the inner ring and one pressed steel window-type cage for each roller row**

# RKB CC design and applications



The RKB spherical roller bearings with the CC type cage are particularly wear and fatigue resistant, endowed with superfinished rollers. In more detail, the CC design cage is a stamped steel, window- or pocket-type cage, featuring high load capacity, long life, high-speed capability, low weight, and low noise and vibration rates. Used for special guide rolls in continuous slab casting machines, the stamped steel cage of this bearing keeps the rotating rollers in a stable condition allowing for minimum temperature rise and improved operating time.

# RKB CC design and applications



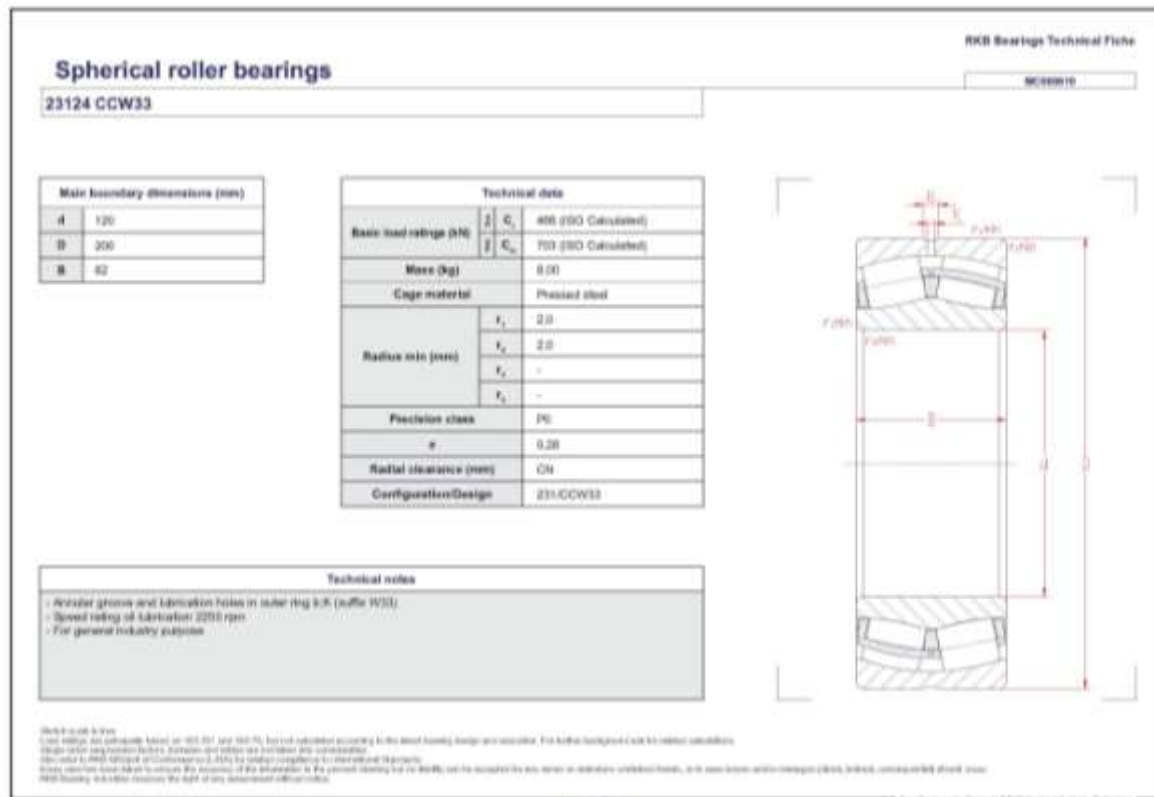
Solid or hollow section strands can be produced by continuous casting machines. The molten steel flows into the top of the mould, cooling the surface of the steel and providing it with rigid skin and glowing core. The strand is guided in the bending zone from the vertical to the horizontal plane by means of water-cooled rollers supported by rolling bearings, in preparation for the cooling and straightening line.

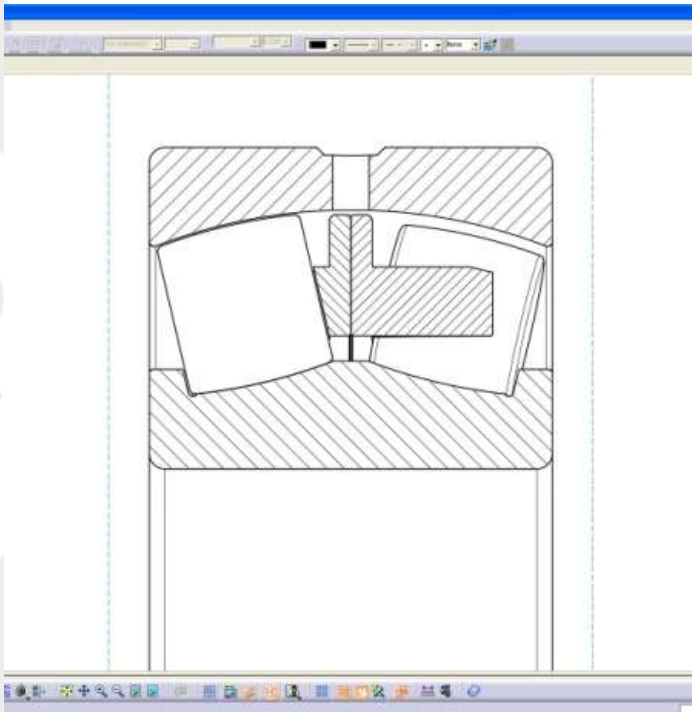
The bearings supporting the rollers are subjected to high radial loads, high temperatures, misalignment and contamination (water spray, water vapor, scale).

For this application, the solution developed by RKB is represented by CC design which allows for a significantly reduced cage section. This type of cage eliminates the need for the inner ring retaining flanges and allows for more and larger rollers, thus enhancing load carrying capacities.

The cage is made of two pieces, enabling the two rows of rollers to move independently from each other, which may be beneficial in higher-speed machines or applications with extreme thrust loading and misalignment. These features provide an improved roller control and lower friction.

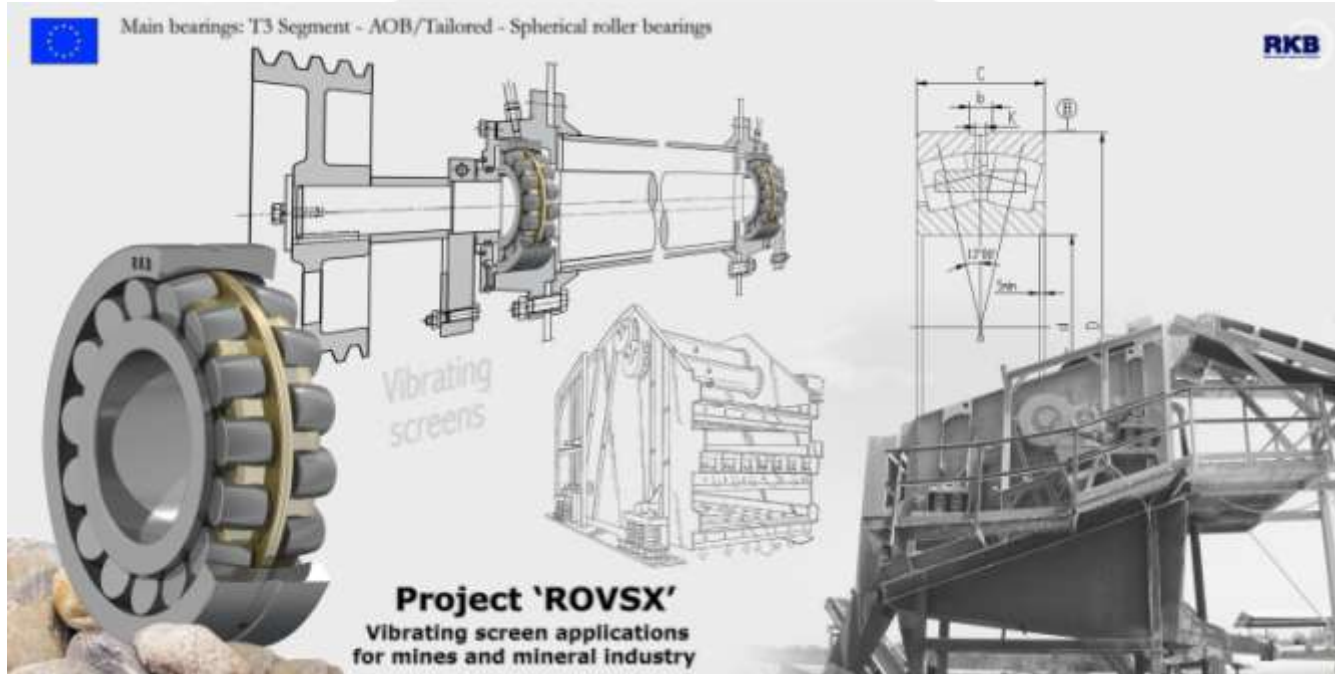
# RKB CC design: example of Technical Fiche





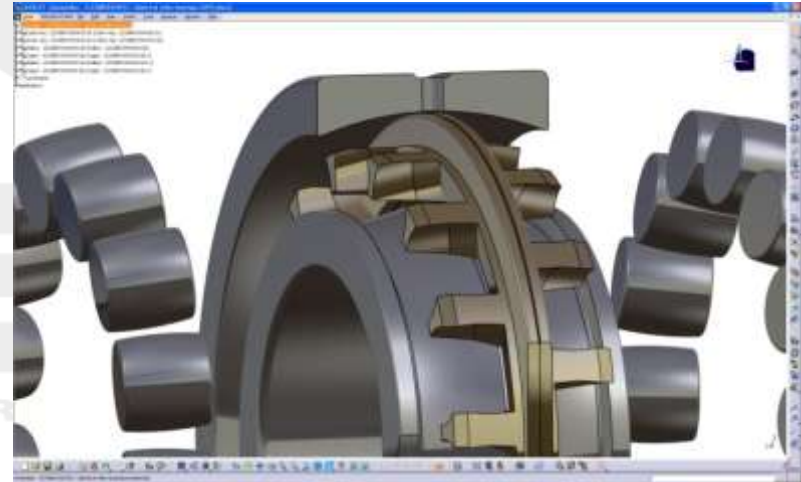
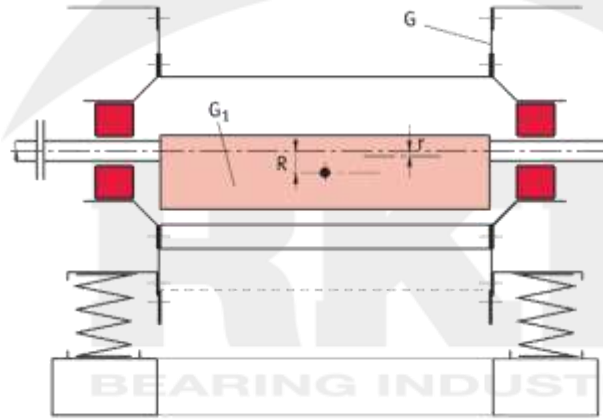
**Two-piece machined brass cage guided on the outer ring and retaining flanges on the inner ring**

# RKB MA design and applications



The MA design is mainly suited for mineral crushing, screening and compacting and vibratory machinery in general, where the centrifugal forces induce accelerations of bearing rollers and cages. The very high basic load ratings of this specific type of bearings make them suitable for use in heavy load applications. The RKB Bainite Treatment (HB) for the inner and outer ring is carried out for better performing in applications where there are high tensile interference fits and high shock loads. Also, the RKB Tough Roller Technology is commonly applied.

# RKB MA design and applications



The mechanical tools for separating, sorting and cleaning solids, liquids and powders, by using gravity motions and mesh screens, are known as vibrating screens. These tools are used in various industries such as mining, chemical and construction.

The RKB spherical roller bearings encompassing the MA configuration for vibrating screen applications are identified by the ROVSX designation. This configuration is used for medium and large size bearings, having two lateral retaining ribs on the inner ring and the two-piece solid brass cage guided on the outer ring.

In these complex applications, bearings operate in severe conditions being subjected to heavy loads including impact loads, that lead to shaft and housing deflections. Extra loading acting on the bearing is produced by the "g" forces generated by an increased acceleration in the application, thus producing vibrations. These vibrations are caused by the shaft due to the eccentricity between the axis of revolution and the center of mass.

This requires the bearing to accommodate the resulting misalignment. Bearings are also subjected to higher speeds and contaminated environments.

## RKB MA design: example of Technical Fiche

### Spherical roller bearings

22328 ROVSXW33

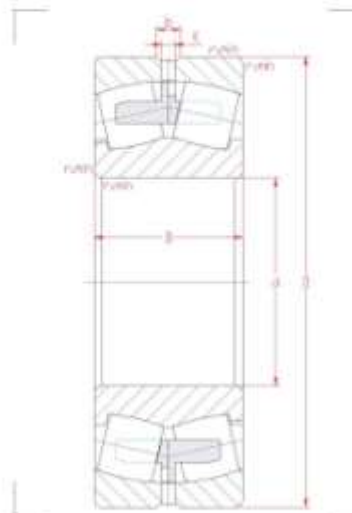
RHB Bearings Technical Facts

0542-9894/10

Main boundary dimensions (mm)	
d	140
D	300
B	102

Technical data	
Basic load ratings (kN)	$C_0$ 1200 $C_0$ 1550
Mass (kg)	35.0
Cage material	Brass
Radius min (mm)	$r_1$ 4.0
	$r_2$ 4.0
	$r_3$ -
	$r_4$ -
Position class	Special POPE
$\alpha$	0.35
Radial clearance (mm)	Special C4
Configuration/Design	223PROVSW03

Technical notes
<ul style="list-style-type: none"> <li>- Special resolution for vibrating screen applications. New X generation</li> <li>- Aerial groove and lubrication holes in roller ring O.K. (pat. W33)</li> <li>- Mounted brass cage in two pieces guided in roller ring</li> <li>- Rings with knurled treatment and dimensionally stabilized SS</li> <li>- Speed rating oil lubrication 2000 rpm</li> <li>- For general industry purpose</li> </ul>



1800-355-5555

Cost values are primarily based on 1991-1992 and 1992-1993, but are adjusted according to the latest known input and output. The factor multipliers are as follows:

Single factor experimental factors: variables are treated as continuous

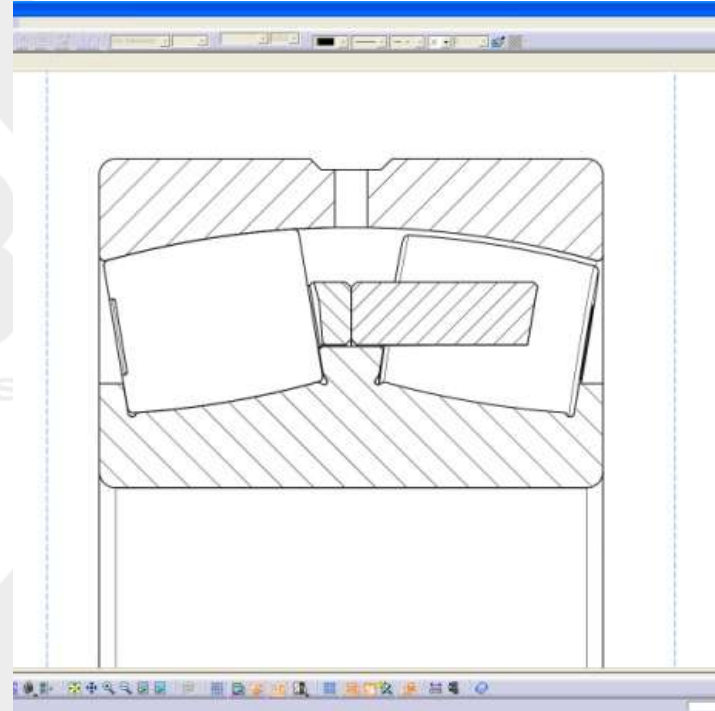
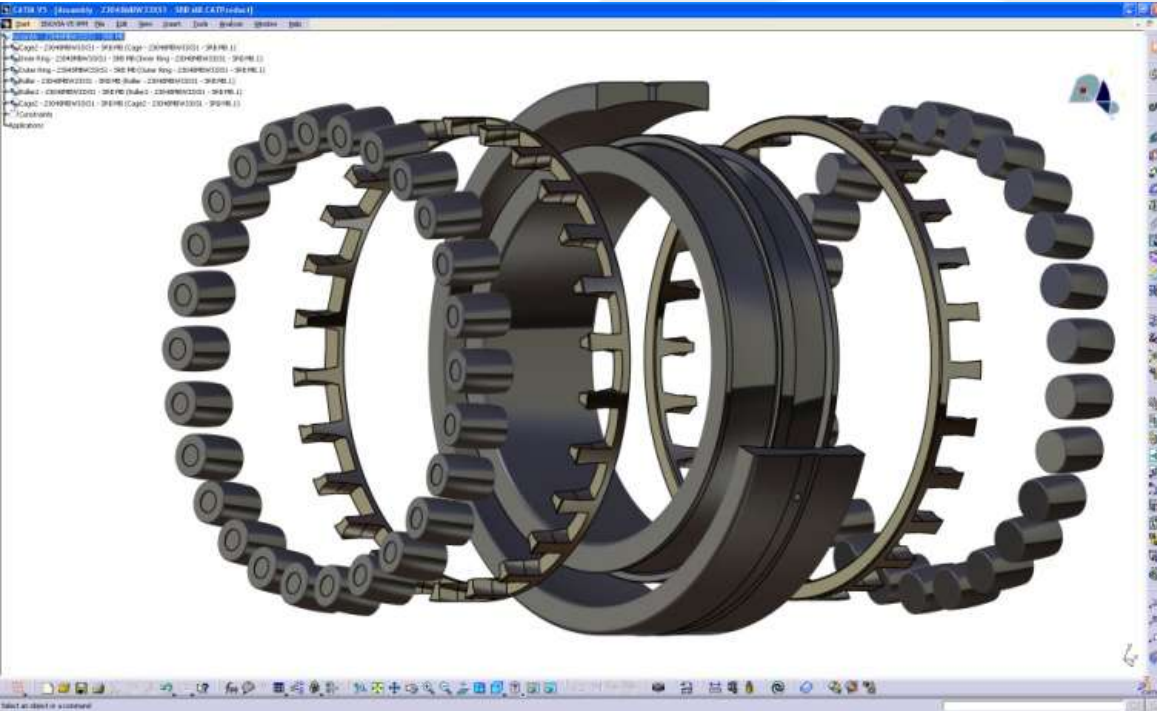
© 2006 Blackwell Publishing Ltd, *Journal of Internal Medicine* 260: 101–108

© 2000 Blackwell Science Ltd, *Journal of Internal Medicine* 247: 399–406

© 2004 Blackwell Publishing Ltd, *Journal of Internal Medicine* 255: 103–110

---

# RKB MB design and applications



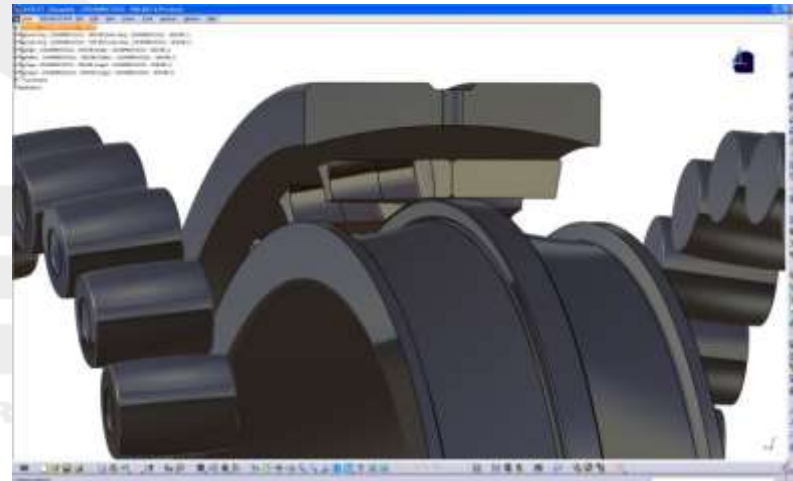
**Two-piece machined brass cage guided on the inner ring central fixed rib and retaining flanges on the inner ring**

# RKB MB design and applications



The MB design is commonly used for medium size bearings and presents medium to high speed suitability, high load capacity and the ability to work in applications operating under heavy loads and severe conditions. The MB cage is a two-piece machined brass cage, guided on the inner ring central fixed rib, which ensures the accommodation of varying degrees of misalignment, and with retaining flanges on the inner ring. In applications such as pulp and paper calender mills, the MB design withstands shaft deflections and high rollers speeds.

# RKB MB design and applications



Pressure and heat is applied to the passing paper in the case of pulp and paper mills, where the calendar consists of a number of rolls and is used to obtain the finishing part of the paper surface. The source of the heavy loads acting on the bearing is the pressure applied by the rollers to the web, providing a smooth finish quality.

The separable cage ensures a better performance at relative speeds and, if needed, lets the rows of rollers perform at different pace. High quality lubricant is essential for this type of bearings operating at high speeds and under heavy conditions.

Besides, the rings are dimensionally stabilized for operating temperatures up to  $+200\text{ }^{\circ}\text{C}$ .

Paper lines are applications that require bearings to continuously operate without failure, in spite of ever-increasing speeds (higher than  $900\text{ m/min}$ ), extreme moisture and high operating temperatures. Extended service life represents RKB's major goal.

Depending on series and dimensions, the rollers can be of symmetrical or asymmetrical design. Care has to be paid to stress concentrations in applications with extremely heavy loads.

# RKB MB design: example of Technical Fiche

RKB Bearings Technical Fiche

Spherical roller bearings

90C38018

23044 MBC3W33

Main boundary dimensions (mm)

d	220
D	340
B	90

Technical data

Basic load ratings (kN)	$\frac{C}{d^3}$	1854 (ISO Calculated)
	$\frac{C}{D^3}$	1855 (ISO Calculated)
Mass (kg)		31.0
Cage material		Brass
Radius min (mm)	$r_1$	3.0
	$r_2$	3.0
	$r_3$	-
	$r_4$	-
Precision class		P0
$\sigma$		0.34
Radial clearance (mm)		C3
Configuration/Design		230MBW33

Technical notes

- Angular groove and lubrication holes in outer ring to K (suff. W33)
- Machined brass cage in two pieces guided on inner ring
- Symmetrical rollers
- Speed rating oil lubrication 1485 rpm
- For general industry purpose

Weight table in kg

Load ratings are ultimately based on ISO 2781 and ISO 2782, typical calculations according to the above bearing design and application. For further background look for related calculations (single, double and angular factors, formulas and tables are not taken into consideration).

For more details, visit our Customer service site for further information on maintenance (lubrication).

Please, send two lower balls to ensure the accuracy of the illustration in the present drawing for no liability can be accepted for any errors or omissions contained therein, or in our books and/or catalogues (print, internet, computerized) should occur.

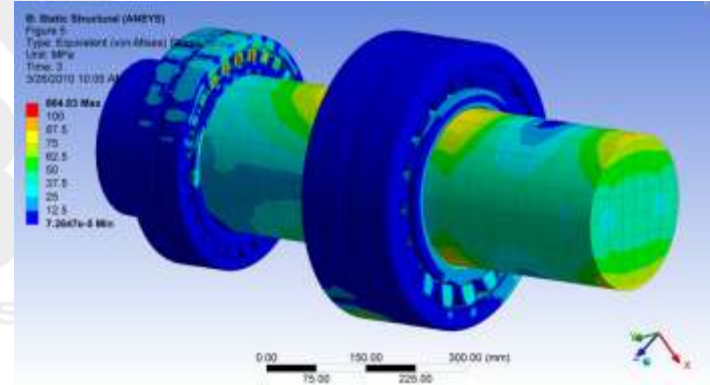
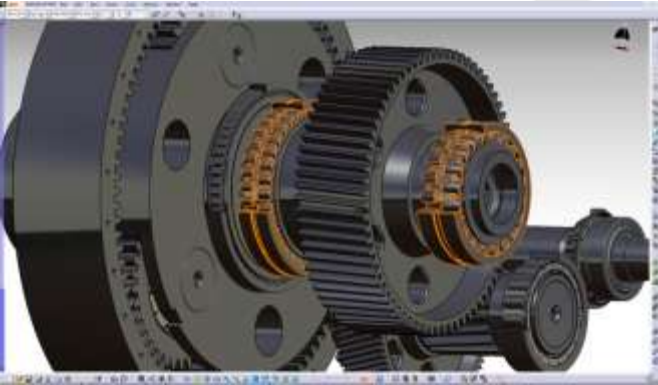
RKB Bearings installation indicates the right way to avoid bearing failure.

# RKB bearing selection

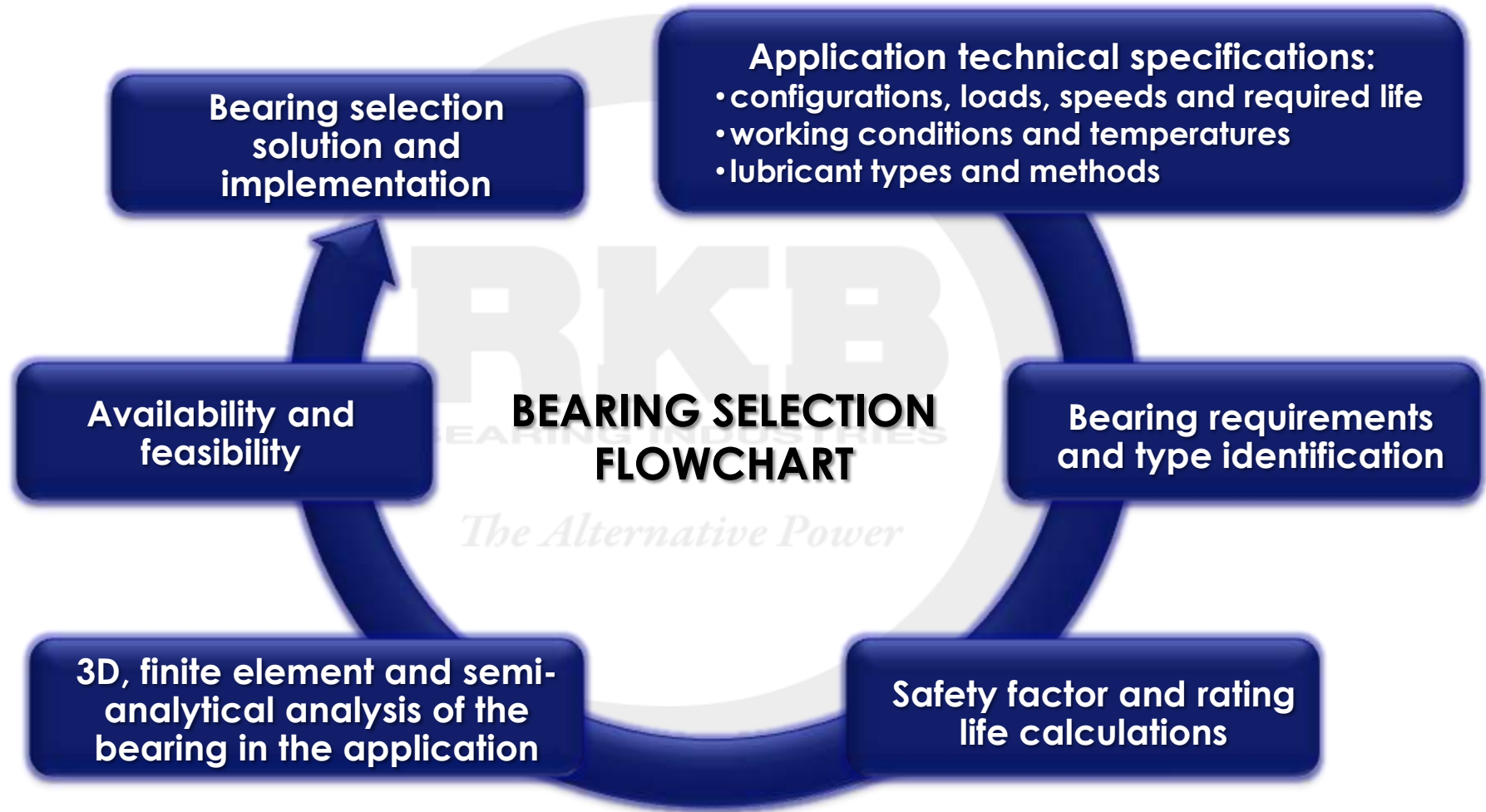


Load rating capacities are fundamentally used by machine designers to select the bearing size for a given application. The RKB Main Technical Data Sheet (MTDS) software system offers consistent background information on the calculation of the static and dynamic load ratings of a bearing, based on ISO 281 and ISO 76. Through the MTDS, the RKB Bearing Industries Group is able to prove the reliability of its own bearings by clearly and straightforwardly following the mathematical equations defined by ISO. (for further information refer to the related educational video "RKB Software Systems for Bearing Calculations: MTDS").

# RKB bearing selection



In addition, RKB takes advantage of dedicated bearings software packages, which are used to determine the application forces, the load distribution on each bearing or roller, the Hertzian and non-Hertzian contact stresses, the bearing fatigue life, misalignments, and more. These software products can manage complex applications by considering all the factors that may influence the bearing behavior (speeds, moments, loads, position on the shaft and misalignment angle, tolerance and cleanliness classes, lubricant type, temperature etc.), according to the latest ISO standards.  
(for further information refer to the related educational video “RKB Software Systems for Bearing Calculations: RRLC”).



# Conclusions

## **RKB SPHERICAL ROLLER BEARINGS:**

- RKB HAS LONG STANDING EXPERIENCE IN DESIGNING AND MANUFACTURING SPHERICAL ROLLER BEARINGS, WITH, AT PRESENT, MORE THAN 2750 DIFFERENT TYPES ENGINEERED, UP TO 1580 MM
- IN CASE OF SPECIFIC APPLICATIONS, IT IS ESSENTIAL TO CHOOSE THE PARTICULAR AND MOST SUITABLE CAGE CONFIGURATION
- IN CASE OF STANDARD APPLICATIONS, EACH CAGE CONFIGURATION IS INTERCHANGEABLE WITH ANY OTHER, OFFERING ANYWAY GOOD RUNNING PERFORMANCES
- THE DIFFERENCES IN PERFORMANCE BETWEEN STEEL AND BRASS CAGES ARE NEGLIGIBLE
- THE EVALUATION OF THE BEARING CHARACTERISTICS HAS TO BE GROUNDED IN CLEAR AND RELIABLE TECHNICAL INFORMATION, AND NOT IN MERE MARKETING ACTIVITIES