

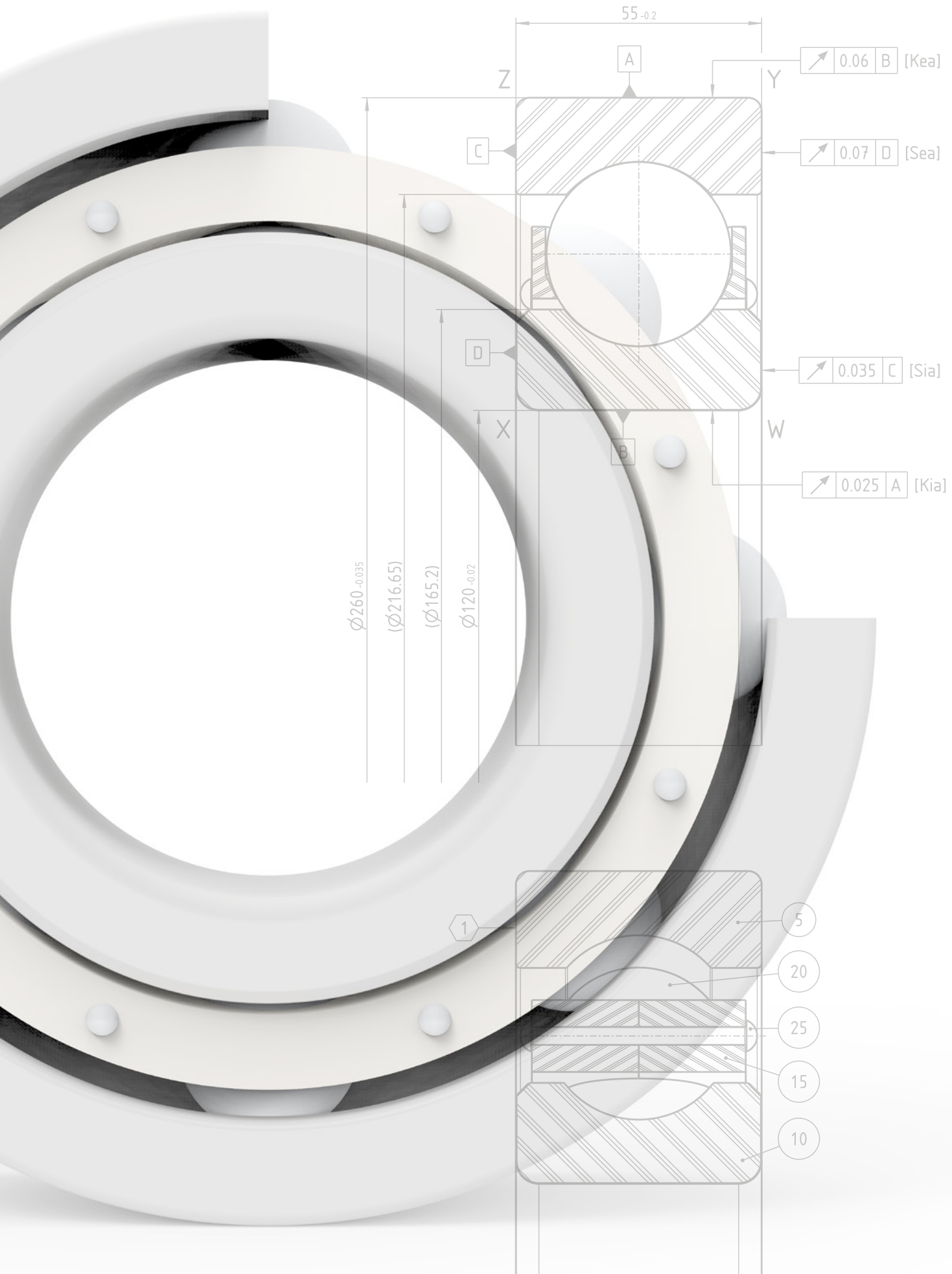
www.krw.de

KRW Leipzig

Current-insulated Bearings

Product range

MADE IN GERMANY



KRW Product range

Current-insulated Bearings

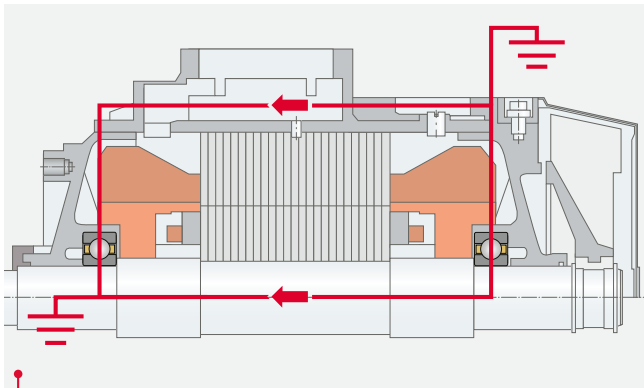
Traction motors in rail vehicles, DC and AC motors in drive technology, and generators in wind turbines are commonly mounted on rolling bearings. The rolling bearings in these machines are often exposed to the risk of electrical current passing through them, which can cause the lubricant to degrade and damage the raceways and rolling elements. This can lead to premature bearing failure and unplanned machine downtime. In addition to the costs for new rolling bearings, high expenses are then also incurred for machine repair as well as for production loss.

For these applications, Kugel- und Rollenlagerwerk Leipzig GmbH recommends electrically insulated rolling bearings which offer reliable protection against the passage of current. Current-insulated bearings from KRW are available in a range of design variants – to suit your individual requirements.

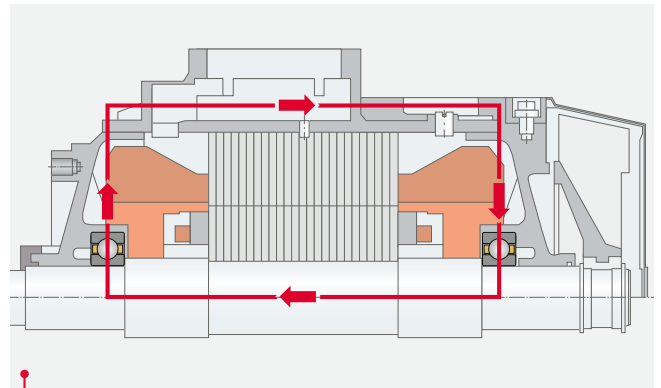


Prevention of passage of current

It is difficult to eliminate the particular cause of electric voltage on the rolling bearing. Where bearing currents cannot be sufficiently eliminated at source, bearing damage can be prevented by interrupting or diverting the current path through the bearing. Here, the use of current-insulating coatings or ceramic rolling elements eliminates the need for costly conventional insulation methods.



Non-insulated rolling bearings in a standard three-phase motor; harmful current flow between the shaft and the housing



Non-insulated rolling bearings in a standard three-phase motor; damaging current flow parallel to the shaft

Voltage between shaft and housing

If voltage occurs between the shaft and housing, current flows in the same direction through each of the two bearings. Both bearing current paths must be interrupted; depending on the electrical concept, this may require insulation of both bearings.

When selecting the current insulation, the time characteristic of the applied voltages must be taken into account. The ohmic resistance is decisive in the case of a DC voltage or a slowly varying AC voltage. In these cases, ceramic-coated rolling bearings are a particularly good remedy against rolling bearing damage caused by current flow.

In the case of a higher-frequency AC voltage, on the other hand, the capacitive resistance of the bearing is important. In such cases, the use of hybrid bearings may be particularly advantageous to prevent current flow damage.

Induced voltage along the shaft

Uneven distribution of magnetic flux in the motor often results in an induced voltage along the shaft. This creates an electric circuit that closes via bearing A, the housing and bearing B. Insulating one of the two bearings is sufficient to interrupt the current flow.

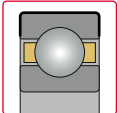
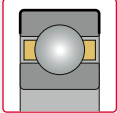
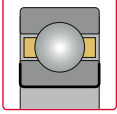
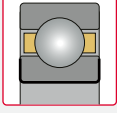
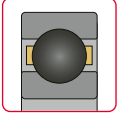
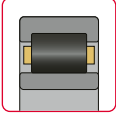
Preventing the passage of current with solutions from KRW

In electrical machines and drives, potential differences may occur between the rotor and stator or between the shaft and housing. To prevent potential equalization via the bearings, KRW uses **current-insulating coatings up to 3,000 VDC**. The oxide ceramic insulated coating is applied to the outside diameter and end faces or the bore diameter of the bearing rings. This eliminates the need for costly conventional insulation methods.

If it is not structurally possible or practical to insulate the bearings, bearing insulation washers are used instead. These are utilized, for example, to protect large axial bearings. **Insulation washers** are available from KRW up to a diameter of 1,300 mm and a maximum breakdown voltage of up to 3,000 VDC.

The main dimensions of current-insulated bearings are identical to those of standard bearings, making it easy to change from standard to electrically insulated rolling bearings.

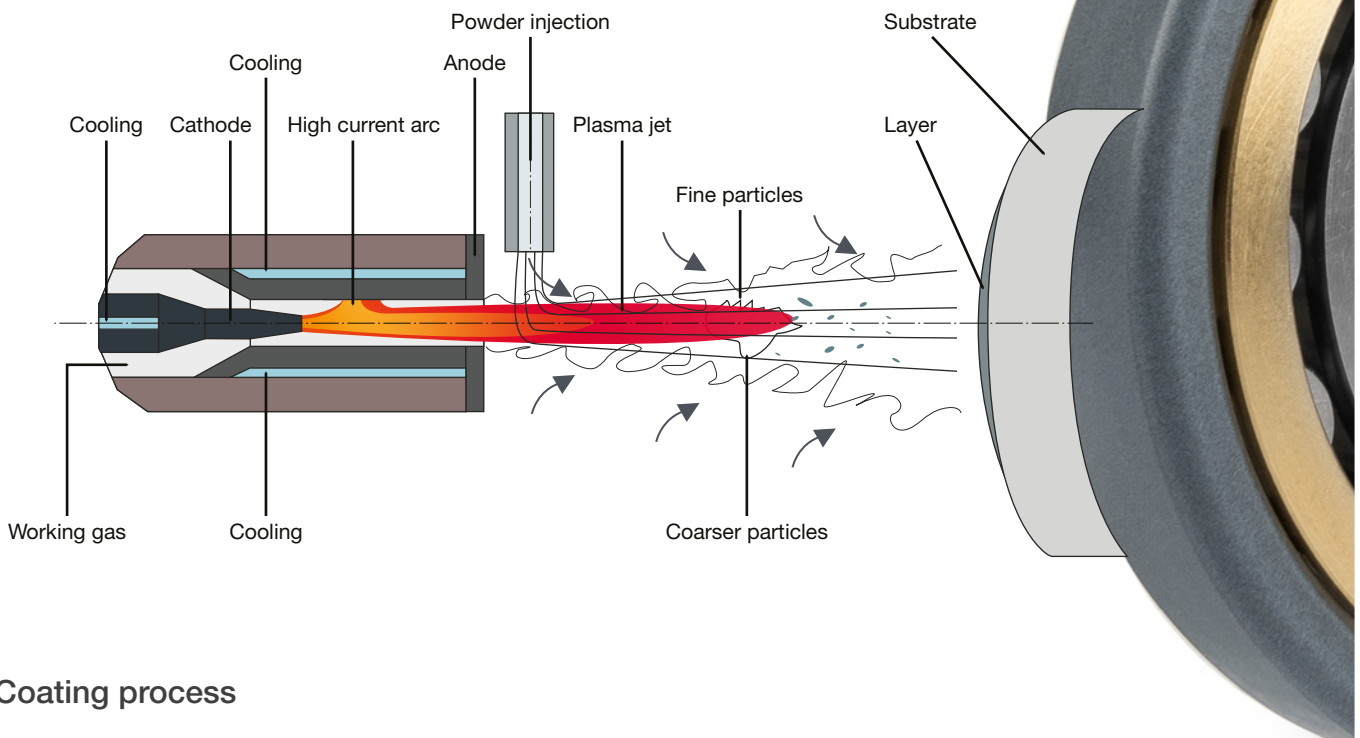
KRW Suffixes – current-insulated and hybrid bearings

KRW Suffix	Description		
	Oxide ceramic insulation	Insulation	
SJ10	Al ₂ O ₃ with TiO ₂ on outer ring	up to 1,000 V	
SJ30	Al ₂ O ₃ with TiO ₂ on outer ring	up to 3,000 V	
SJ10J	Al ₂ O ₃ with TiO ₂ on inner ring	up to 1,000 V	
SJ30J	Al ₂ O ₃ with TiO ₂ on inner ring	up to 3,000 V	
HC5	Rolling elements made of Si ₃ N ₄	up to 3,000 V – suitable for higher-frequency currents	 
...other designs available on request			

Oxide ceramic coating

White ceramic coating of **aluminum oxide (Al_2O_3)** provides good resistance to hardness, wear resistance and electrical insulation.

The gray-blue insulation of **aluminum oxide and titanium dioxide (Al_2O_3 with TiO_2)** has a higher fracture toughness and better resistance to shock and impact than a coating of pure aluminum oxide due to the proportion of titanium oxide.



Coating process

The oxide ceramic coating on current-insulating rolling bearings is applied by means of plasma spraying. By this treatment, a DC voltage generates an arc between two electrodes, the process gas is ionised, creating a plasma jet.

This plasma jet is fed with an oxide ceramic powder mixture, which is melted by the high plasma temperature. The plasma stream carries the powder particles, which are blown in with the aid of a carrier gas, and sprays them at high speed onto the outer or inner ring (substrate) to be coated. The ceramic layer applied in this way adheres very well to the prepared surfaces of the bearing components. Finally, it is ground and sealed.





Hybrid bearings

Hybrid KRW bearings (suffix HC5) offer another option for current insulation. Ceramic rolling elements, e.g. made of **silicon nitride (Si_3N_4)**, are used here. They offer reliable protection against passage of current even at high AC voltages and temperatures.

KRW supplies hybrid bearings **in the types of ball bearings and cylindrical roller bearings**. Special dimensions are also available on request.



The advantages of KRW bearings at a glance

Current-insulated bearings

- An economical and efficient solution to protect against current passage damage to rolling bearings
- The main dimensions, tolerances, and assembly/disassembly procedures are identical to those of standard bearings
- Better operational reliability and greater availability
- Defined minimum dielectric strength (depending on the design)
- No additional insulation of bearing points necessary

Hybrid bearings

- High electrical resistance
- Higher speed capability compared with equivalent all-steel bearings in suitable applications
- Better emergency running properties than standard bearings
- Potential for extended grease service life and reduced lubricant consumption, depending on the application
- Potential for longer service life under demanding operating conditions
- Separate external bearing-seat insulation is generally not necessary when the selected bearing provides sufficient electrical insulation for the application

Flexible manufacturing

We see ourselves as partners with our customers, so we are always working to make you even more competitive. That is why Kugel- und Rollenlagerwerk Leipzig GmbH continuously invests in the development of new, innovative, and cutting-edge products. As a medium-sized rolling bearing manufacturer, we are very proud of our high degree of vertical integration. We employ variable manufacturing cells and state-of-the-art processing technologies in all areas of production.



Our expertise for your success

Expert knowledge and flexibility are what define the development process at KRW, especially when the standard is not the solution. Our experts in application engineering and product development always see the bearing as one element of an entire machine. This is why we are able to support our customers with our extensive knowledge and find the best solution for every bearing arrangement.

- Standard rolling bearings
- Bearings in special dimensions
- Integrated bearing solutions
- Customized rolling bearings
- Application-optimized bearing solutions
- Rolling bearing components
- Special precision components
- Rolling bearing accessories

Service and Engineering

In addition to the common standard rolling bearing types, the KRW portfolio offers an extensive range of special bearings for individual bearing solutions. Our application engineers will support you from the selection and configuration of the best rolling bearing solution through to assembly and disassembly on your site.



KRW employee checking the inner ring temperature during rolling bearing mounting

Mounting support

Preliminary damage during assembly or handling of rolling bearings is the second most common cause of premature bearing failure after lubrication. Large and heavy rolling bearings in particular are not easy to assemble. They can be easily damaged by carelessness, improper transport, or errors made during assembly.

Avoid these unnecessary problems and costs! Our engineers will advise you before the installation of the bearing and help you to avoid initial mistakes. We will recommend the best assembly strategy and will be there to support you on site.

Diagnosis and damage analysis

Rolling bearings are by far among the most heavily stressed machine components. When there are mechanical problems, therefore, the most obvious signs and the heaviest damage are often found on the bearings.

However, the rolling bearing itself is only rarely the cause. We help you to find the cause of the bearing failure and to avoid future damage.

Take advantage of our experience and our extensive capabilities:

- Visual bearing diagnosis
- Lubricant analysis
- Metallographic testing and evaluation of rolling bearings
- Metrological analysis of all components
- Measurement of form deviations and surface structures of rolling bearing components
- SEM/EDS analysis for damage morphology and elemental analysis, including the assessment of features associated with electrical erosion
- Design- and calculation-based verification of the bearing arrangement
- FE analysis of machine components and strength analysis

The experienced KRW application technology team will be pleased to support you.

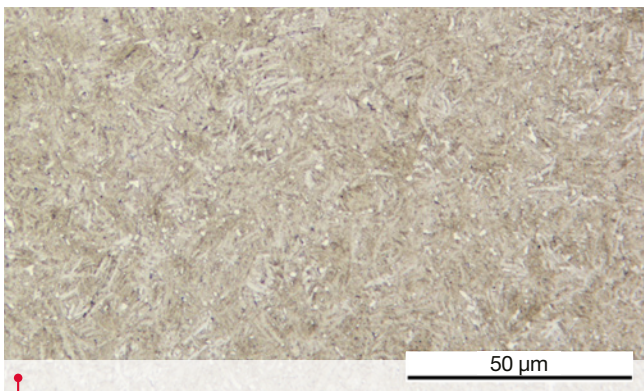
Quality and Certification

High-precision rolling bearings require first-class quality. This is ensured by our innovative manufacturing processes, our quality management system, and our high standards of occupational safety and environmental protection. Quality assurance is an important part of our manufacturing process and is supported by regular audits. This ensures consistently exceptional product quality for our customers.

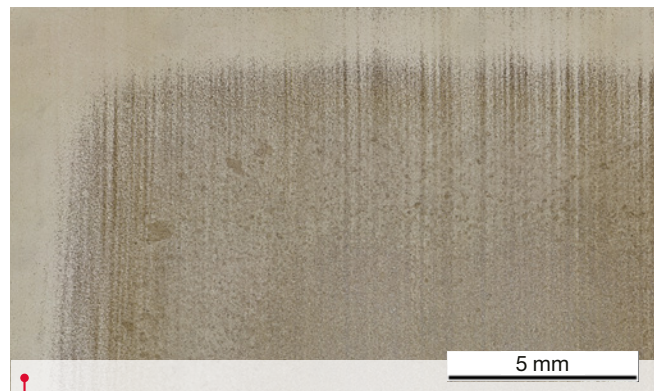
Materials testing

In addition to material technology tests such as hardness testing, metallographic examinations, the determination of chemical composition, the assessment of steel cleanliness/non-metallic inclusion content, and the evaluation of the respective microstructures are possible.

Ultrasonic, magnetic particle, eddy current, and grinding burn tests are also carried out in our in-house materials testing laboratory.



Microstructure of a rolling bearing component made from through-hardening steel



Microstructure of a rolling bearing component made from case-hardening steel

Certified quality

Our quality management is certified according to DIN EN ISO 9001. In addition, the KRW energy management system meets the high requirements of DIN EN ISO 50001.

As a Q1 supplier of Deutsche Bahn with manufacturer-related product qualification (HPQ), KRW has been qualified to supply safety-relevant components such as wheelset bearings for several decades.

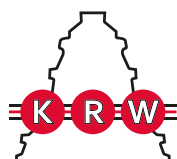




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Current-insulated bearings



Hybrid bearings

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