Solutions for the rail industry

Increasing reliability, reducing maintenance and improving safety

Accelerate your innovation journey

Improved safety and reliability at any speed. Harsh climates and ever-changing weather. Maintenance-free targets of more than one and a half million kilometers. The demand for reduced environmental impact. The rail industry faces many significant operating and regulatory challenges.

SKF is helping the industry overcome these challenges and many more with a wide range of technological and service solutions. SKF is at the forefront of developments in rail technology to produce faster, quieter, safer and more efficient trains, and provides tools to manage these assets throughout their lifecycle for maximum productivity.

Geared to meet the requirements of manufacturers and operators alike, SKF railway service expertise originates from engineering knowledge that goes back many decades, when SKF first helped develop, design and test wheelset bearings across Europe.

Global solutions for rail around the world

Today, the solutions and services available from SKF for the railway industry include a global network of production, service and remanufacturing centres, all of them supported by a highly trained network of sales, application and service engineers.

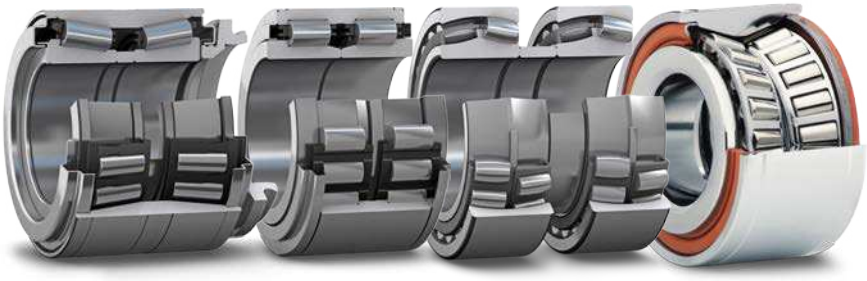
Whether it is providing advanced axlebox bearings, installing lubrication systems, validating reliability and safety requirements, performing bearing mounting and replacements, or conducting training on bearing solutions, these valuable solutions and others from SKF are helping to keep the ever-expanding railway industry on track.

SKF solutions for rail provide:

- **Reduced Total Cost of Ownership (TCO)**
- **Reduced maintenance costs**
- **Longer maintenance intervals and service life**
- **Operational safety and reliability**
- **Reduced noise and vibration**
- **Increased energy efficiency**

Passenger and locomotive solutions

SKF helps develop many types of axleboxes for different bogies. We design for increased reliability and safety, as well as downsizing to meet weight restrictions. In addition SKF offers package solutions including monitoring of relevant operational parameters like speed, positioning, temperature, vibration and more.



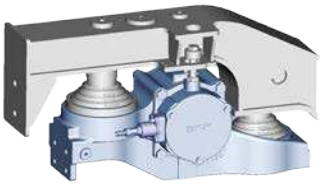
Axlebox bearings and packages

Axlebox bearings from SKF help reduce operating temperatures, extend maintenance intervals and more.

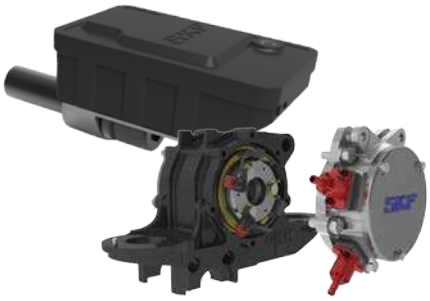
Tapered roller bearing units (TBU) and compact tapered roller bearing units (CTBU) incorporate polymer spacers to reduce fretting and specially designed seals to lower bearing operating temperature and provide longer grease life and longer maintenance intervals. They consist of two inner rings, one common outer ring, two tapered roller and polymer cage assemblies, a central spacer, grease fill and two sealing systems. Lateral spacers, backing rings and end caps with locking devices can also be added.

Cylindrical roller bearings and units (CRU) have "open" flanges and specially designed and surface-treated roller ends to improve lubrication and reduce friction and operating temperatures. Cylindrical roller units are equipped with sealing shields to provide longer grease life and extended maintenance intervals.

Spherical roller bearings have a long history of performance in axlebox applications. They accommodate misalignment and provide flexibility in axlebox design.



Axlebox packages for railway vehicle manufacturers and operators are solution packages customized for individual specifications. These packages are typically composed of axleboxes, factory lubricated and sealed, ready-to-mount axlebox bearing units, sensors and monitoring systems.



Mechatronic solutions

SKF condition monitoring systems increase vehicle availability by facilitating early fault detection and prevention. They provide automatic guidance for correcting existing or impending conditions, and provide input to condition based maintenance management systems.

Sensorized tapered roller bearing units are compact, ready-to-mount, easy-to-install units that form part of the braking system, optimize frictional engagement of the driving wheels on starting-up, detect the direction of rotation and bearing temperature.

SKF Axletronic is a flexible solution that can be installed in axlebox bearing units or front covers to detect and log:

- **Bearing temperature**
- **Rotational speed**
- **Direction of movement**
- **Vertical and/or lateral acceleration**
- **Position and distance**

Drive system products

Drive system bearings from SKF are designed to cope with variations in speed, temperature, load, vibration, shocks and electrical system properties. Additionally, traction motor bearing units are designed to handle in-application contamination and humidity.

SKF solutions for drive systems include:

- **Deep groove ball bearings**
- **Cylindrical roller bearings**
- **Hybrid bearings**
- **Locating and non-locating traction motor bearing units (TMBU)**
- **TMBU with sensor capabilities**
- **Tapered roller bearings**
- **INSOCOAT bearings with electrically insulating coating**

For example, INSOCOAT tapered roller bearings for suspension tubes in railway vehicles have an electrically insulating coating, eliminating the problem of electrical erosion in some applications.

Plain bearings

To boost safety and reliability, SKF offers passenger and locomotive customers a range of world-class plain bearings.

Standard spherical plain bearings and rod ends are available in various sizes and designs for many applications. Versatile and robust, they are composed of wear-resistant sliding material for outstanding tribological behaviour.

Special spherical plain bearings and rod ends are tailored to the operational requirements of a particular application. They feature tight tolerances for precision, corrosion protection, and special sealing as needed.

AMPEP self-lubricating spherical plain bearings are excellent solutions when bearing pressures are high, movement slow and maintenance is difficult or even impossible. They provide a low coefficient of friction combined with low wear rates.

Lubrication products

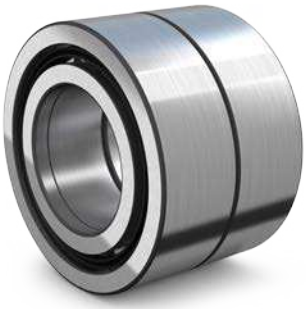
SKF lubrication solutions provide everything from precise, clog-free lubrication to reduced wear, friction and noise.

SKF EasyRail wheel flange lubrication and top-of-rail conditioning systems are mounted on-board on the first leading vehicle axle. When activated, air and lubricant are fed from the grease tank to the spray nozzle. The lubricant is sprayed to the wheel flange in a thin layer and transferred to the gauge face of the rail by direct contact. These systems can be configured for single- and dual-line lubrication system applications, for high and low pressure. SKF EasyRail Airless is available for vehicles without on-board air supply.

All SKF EasyRail systems also are available as top-of-rail conditioning systems in which the nozzles apply the friction modifier directly to the top of the rail. They require low maintenance and operate reliably even under extreme climatic conditions.

Freight solutions

Railway freight operations require technical and economical solutions with low life cycle costs. That's why SKF solutions for the freight industry are designed for increased service life and maintenance intervals, even while operating under fully loaded cars in extreme climate conditions.



Axlebox bearings and packages

Axlebox bearings from SKF help reduce operating temperatures, extend maintenance intervals and more.

SKF tapered roller bearing units (TBU) and compact tapered roller bearing units (CTBU) incorporate polymer spacers to reduce fretting and specially designed seals to lower bearing operating temperature and provide longer grease life and longer maintenance intervals. They consist of two inner rings, one common outer ring, two tapered roller and polymer cage assemblies, a central spacer, grease fill and two sealing systems. Lateral spacers, backing rings and end caps with locking devices can also be added.

Cylindrical roller bearings and units (CRU) from SKF have "open" flanges and specially designed and surface-treated roller ends to improve lubrication and reduce friction and operating temperatures. Cylindrical roller units are equipped with sealing shields to provide longer grease life and extended maintenance intervals.

Spherical roller bearings have a long history of performance in axlebox applications. They accommodate misalignment and provide flexibility in axlebox design.

Axle bearings for adapter bogie designs are special tapered roller bearing units with the advantages of multiple material combinations for higher reliability. For heavy haul freight wagons, we provide special compact tapered bearing units for axle loads up to 45 tonnes.

Axlebox packages for railway vehicle manufacturers and operators are solution packages customized for individual specifications. These packages are typically composed of axleboxes, factory lubricated and sealed, ready-to-mount axlebox bearing units, sensors and monitoring systems.

Plain bearings

To boost safety and reliability, SKF offers freight customers a range of world-class plain bearings.

Standard spherical plain bearings and rod ends are available in various sizes and designs for many applications. Versatile and robust, they are composed of wear-resistant sliding material for outstanding tribological behaviour.

Special spherical plain bearings and rod ends are tailored to the operational requirements of a particular application. They feature tight tolerances for precision, corrosion protection, and special sealing as needed.

Lubrication products

SKF lubrication solutions provide everything from precise, clog-free lubrication to reduced wear, friction and noise.

Lincoln wheel flange lubrication systems from SKF substantially contribute to reduced wear, friction and noise. These systems can help operators reduce maintenance costs and improve fleet availability, all while reducing their environmental impact.

Lincoln's wayside systems for gauge face lubrication and top-of-rail conditioning use track-mounted wheel sensors to detect passing trains. The applied lubricant is picked up by passing wheels.

High-pressure, low-volume pumps effectively cover the rail with just enough lubricant, minimizing waste. A wiper bar with an integrated progressive metering device applies the lubricant or friction modifier directly to the gauge face or top-of-rail. Lincoln's progressive pump-to-port technology (PTP) enables exact metering of grease, helping to ensure each lube port receives the same small amount of grease every time, automatically.

The systems are capable of pumping long distances, as well as high-viscosity lubricants. Dual track systems and customized solutions are available.

Systems include:

- Gauge face lubrication (GF)
- Top-of-rail conditioning (TOR)
- Restraining rail lubrication
- Combination of GF and TOR

High-speed rail solutions

Since the birth of high-speed rail, SKF has been developing solutions to meet the challenging requirements of high-speed train builders and operators, for the development, design and testing of wheelset bearings. From providing increased safety and reliability in all weather conditions, to maintenance-free periods of over a million and a half kilometres, SKF solutions are optimized to meet the high-speed rail industry's needs.

Axlebox bearings and packages

Axlebox bearings from SKF help reduce operating temperatures, extend maintenance intervals and more.

Tapered roller bearing units (TBU) incorporate polymer spacers to reduce fretting and specially designed seals to lower bearing operating temperature and provide longer grease life and longer maintenance intervals. They consist of two inner rings, one common outer ring, two tapered roller and polymer cage assemblies, a central spacer, grease fill and two sealing systems. Lateral spacers, backing rings and end caps with locking devices can also be added.

Cylindrical roller bearings and units (CRU) have "open" flanges and specially designed and surface-treated roller ends to improve lubrication and reduce friction and operating temperatures. SKF cylindrical roller bearing units for high speed applications are specifically designed to cope with extremely demanding operating conditions.

Axlebox packages for railway vehicle manufacturers and operators are solution packages customized for individual specifications. These packages are typically composed of axleboxes, factory lubricated and sealed, ready-to-mount axlebox bearing units, sensors and monitoring systems.

Mechatronic solutions

Condition monitoring systems from SKF increase vehicle availability by facilitating early fault detection and prevention. They provide automatic advice for correcting existing or impending conditions, and provide input to condition based maintenance management systems. SKF offers condition monitoring systems that satisfy TSI requirements for high speed applications.

Sensorized tapered bearing units are compact, ready-to-mount, easy-to-install units that form part of the braking system, optimize frictional engagement of the driving wheels on starting-up, detecting the direction of rotation and bearing temperature.

SKF Axletronic is a flexible solution that can be installed in axlebox bearing units or front covers to detect and log:

- **Bearing temperature**
- **Rotational speed**
- **Direction of movement**
- **Vertical and/or lateral acceleration**
- **Position and distance**

Drive system products

Drive system bearings from SKF are designed to cope with variations in speed, temperature, load, vibration, shocks and electrical system properties. Additionally, traction motor bearing units are designed to handle in-application contamination and humidity.

SKF solutions for drive systems include:

- **Deep groove ball bearings**
- **Cylindrical roller bearings**
- **Hybrid bearings**
- **Locating and non-locating traction motor bearing units (TMBU)**
- **TMBU with sensor capabilities**
- **Tapered roller bearings**
- **INSOCOAT bearings with electrically insulating coating**

Plain bearings

To boost safety and reliability, SKF offers a range of world-class plain bearings.

Standard spherical plain bearings and rod ends are available in various sizes and designs for many applications. Versatile and robust, they are composed of wear-resistant sliding material for outstanding tribological behaviour.

Special spherical plain bearings and rod ends are tailored to the operational requirements of a particular application. They feature tight tolerances for precision, corrosion protection, and special sealing as needed.

AMPEP self-lubricating spherical plain bearings are excellent solutions when bearing pressures are high, movement slow and maintenance is difficult or even impossible. They provide a low coefficient of friction combined with low wear rates.

Lubrication products

SKF lubrication solutions provide everything from precise, clog-free lubrication to reduced wear, friction and noise.

SKF EasyRail wheel flange lubrication and top-of-rail conditioning systems are mounted on-board on the first leading vehicle axle. When activated, air and lubricant are fed from the grease tank to the spray nozzle. The lubricant is sprayed to the wheel flange in a thin layer and transferred to the gauge face of the rail by direct contact. These systems can be configured for single- and dual-line lubrication system applications, for high and low pressure. SKF EasyRail Airless is available for vehicles without on-board air supply.

All SKF EasyRail systems also are available as top-of-rail conditioning systems in which the nozzles apply the friction modifier directly to the top of the rail. They require low maintenance and operate reliably even under extreme climatic conditions.

Metro car and light rail solutions

Vehicles like suburban trains, metros or underground and tramways operate world-wide. To help designers and operators reduce mass, energy consumption, maintenance and operating costs, SKF provides the light rail industry with world-class tapered and cylindrical roller bearing units, axleboxes, axlebridges, remanufacturing services and more.

Axlebox bearings, packages and axlebridges

Axlebox bearings from SKF help reduce operating temperatures, extend maintenance intervals and more.

Tapered roller bearing units (TBU) and compact tapered roller bearing units (CTBU) incorporate polymer spacers to reduce fretting and specially designed seals to lower bearing operating temperature and provide longer grease life and longer maintenance intervals. They consist of two inner rings, one common outer ring, two tapered roller and polymer cage assemblies, a central spacer, grease fill and two sealing systems. Lateral spacers, backing rings and end caps with locking devices can also be added.

INSOCOAT tapered roller bearing units for wheelsets in light railway vehicles may have an electrically insulating coating, virtually eliminating the problem of electrical erosion.

Cylindrical roller bearings and units (CRU) have "open" flanges and specially designed and surface-treated roller ends to improve lubrication and reduce friction and operating temperatures.

Spherical roller bearings have a long history of performance in axlebox applications. They accommodate misalignment and provide flexibility in axlebox design.

Axlebox packages for railway vehicle manufacturers and operators are solution packages customized for individual specifications. These packages are typically composed of axleboxes, factory lubricated and sealed, ready-to-mount axlebox bearing units, sensors and monitoring systems.

Axlebridges from SKF are ready-to-mount systems for low-floor vehicles that provide logistic cost reductions due to fewer components.

Mechatronic solutions

Condition monitoring systems from SKF increase vehicle availability by facilitating early fault detection and prevention. They provide automatic guidance for correcting existing or impending conditions, and provide input to condition based maintenance management systems.

Sensorized tapered bearing units are compact, ready-to-mount, easy-to-install units that control the braking system, optimize frictional engagement of the driving wheels on starting-up, and detect the direction of rotation.

SKF Axletronic is a flexible solution hat can be installed in axlebox bearing units or front covers to detect and log:

- **Bearing temperature**
- **Rotational speed**
- **Direction of movement**
- **Vertical and/or lateral acceleration**
- **Position and distance**

Drive system products

Drive system bearings from SKF are designed to cope with variations in speed, temperature, load, vibration, shocks and electrical system properties. Additionally, traction motor bearing units are designed to handle in-application contamination and humidity.

SKF solutions for drive systems include:

- **Deep groove ball bearings**
- **Cylindrical roller bearings**
- **Hybrid bearings**
- **Locating and non-locating traction motor bearing units (TMBU)**
- **TMBU with sensor capabilities**
- **Tapered roller bearings**
- **INSOCOAT bearings with electrically insulating coating**

Plain bearings

To boost safety and reliability, SKF offers a range of world-class plain bearings.

Standard spherical plain bearings and rod ends are available in various sizes and designs for many applications. Versatile and robust, they are composed of wear-resistant sliding material for outstanding tribological behaviour.

Special spherical plain bearings and rod ends are tailored to the operational requirements of a particular application. They feature tight tolerances for precision, corrosion protection, and special sealing as needed.

AMPEP self-lubricating spherical plain bearings are excellent solutions when bearing pressures are high, movement slow and maintenance is difficult or even impossible. They provide a low coefficient of friction combined with low wear rates.

Slewing bearings

Feature a compact assembly with integrated options including, lubrication and seals that prevent grease leakage and protect against water and dust. SKF also offers the option of corrosion resistant slewing bearing designs.

Lubrication products

SKF EasyRail wheel flange lubrication and top-of-rail conditioning systems are mounted on-board on the first leading vehicle axle. When activated, air and lubricant are fed from the grease tank to the spray nozzle. The lubricant is sprayed to the wheel flange in a thin layer and transferred to the gauge face of the rail by direct contact. These systems can be configured for single- and dual-line lubrication system applications, for high and low pressure. SKF EasyRail Airless is available for vehicles without on-board air supply.

All SKF EasyRail systems also are available as top-of-rail conditioning systems. They require low maintenance and operate reliably even under extreme climatic conditions.

Bogie condition monitoring

SKF bogie condition monitoring solutions use condition detection systems and sophisticated algorithms for data processing to help detect incipient damage and allow sufficient time for repairs before significant mechanical failures occur. This predictive maintenance increases reliability and safety, and helps reduce maintenance costs, life cycle costs (LCC) and total cost of ownership (TCO).

Sensorized bearing units from SKF are easy to install and provide the ability to detect:

- **Rotational speed for wheel slip/slide protection (WSP or WSSP) and the traction control unit (TCU)**
- **Bearing temperature signal for the on board monitoring system**
- **Direction of movement**
- **Positioning for the European Train Control System (ETCS) and the Italian SCMT (Sistema controllo movimentazione treno) automatic train control systems**
- **Vertical and/or lateral acceleration**

SKF Axletronic sensors are flexible axlebox sensor solutions that are easily incorporated into both new vehicles and existing rolling stock. The sensors have the ability to detect and log:

- **Bearing temperature**
- **Rotational speed**
- **Direction of movement**
- **Vertical and/or lateral acceleration**
- **Position and distance**

The SKF Axletronic temperature monitoring system is a cost competitive on-board solution. It is used as a safety support system for bearing temperature control for new train installations as well as for retrofitting. The monitoring system is easy to install and is located entirely on the train to transmit warning and alarm messages. Benefits of the system include:

- **Increased reliability and safety**
- **Continuous temperature monitoring and analysis**
- **Event recorder and data buffering**
- **Self-checking intelligent system**
- **Adaptive alarm levels**

SKF Multilog Online System IMx-R helps increase safety, reliability and profitability. Developed exclusively for railway applications, the SKF Multilog Online System IMx-R works with SKF @ptitude Observer software as a complete mechanical condition monitoring and protection system. Benefits of the system include:

- **Increased safety and reliability**
- **Reduced maintenance costs**
- **Improved maintenance and planning**
- **Extended overhaul intervals**
- **Reduced unplanned downtime and standstills**
- **Root cause analysis capabilities**
- **Optimized spare parts logistics**
- **Satisfies TSI safety requirements**

SKF Multilog Online System IMx-B bogie retrofitting solution is ideal for fleet retrofitting and OEMs. This condition monitoring solution is easily installed at bogie level to monitor its components. Vibration, temperature and speed are collected by the IMx-B from sensors on the bogie and calculated values can be sent wirelessly to an office-based server and on-board alert systems. This enables maintenance engineers to see data centrally and monitor the condition of motors, gearboxes, axleboxes, wheels and more. Benefits of the system include:

- **Fewer unplanned service disruptions**
- **Extended maintenance intervals**
- **Reduced maintenance costs**
- **Increased vehicle availability**
- **Fewer instances of unplanned downtime**
- **More efficient maintenance planning**
- **Less passenger inconvenience**
- **More efficient track maintenance**
- **Fast installation and commission**

The SKF Microlog CMXA75 kit for railway comes as a complete kit that includes Microlog, software, vibration sensors and cables. In railway workshops the Microlog can be used to check drives and wheelset bearings during the wheel reprofile process. In train operation service it can be used to troubleshoot various bogie subsystems including traction motors, gear boxes and wheelset bearings. Benefits include:

- **Improves maintenance and planning**
- **Reduces unplanned downtime and standstills**
- **Improves workshop quality procedures**
- **Compact, ergonomic and easy to use**

SKF Insight Rail is an IoT condition monitoring solution for passenger rail train bogies. Wireless and self-powered with an associated remote analysis service. It can't get much easier to obtain smart and flexible maintenance.

Early failures and unplanned stops are too costly, both in terms of money and reputation. With SKF Insight Rail, you can get warnings about potential issues before they develop into failures. It only takes a couple of minutes per wheelset to install and there is no coach installation at all.

By using SKF Insight Rail, you can utilize the full potential of your bearings, harmonize maintenance operations between components and base decisions on facts instead of assumptions.

SKF Insight Rail helps to:

- **Anticipate damages in field before they develop into unplanned maintenance issues**
- **Facilitate maintenance scheduling based on real conditions**
- **Extend maintenance intervals with confidence**

SKF Life Cycle Management

With the life cycle partnership concept, SKF combines all its expertise and technologies to help railway customers improve safety, reliability and profitability across the entire life cycle of the vehicle – from specification to maintenance and repair.

Design and manufacturing

- Application engineering
- Axlebox and bearing design
- Axlebox sensors
- Homologation
- Mechatronic systems
- Sub-assembly kits

Operation

- Refurbishment and remanufacturing of bearings, axleboxes and related products
- Lubrication solutions
- Aftermarket sales, service and technical support
- Condition monitoring of wheelsets and drive systems

Operational knowledge fed back into next generation designs

Extended service life with SKF asset management services

Specification

As market leader and technology trendsetter, SKF is committed to the special demands of the railway industry and offers customized solutions and products to meet these demands.

Design and develop

SKF has designed and developed a range of high performance railway products and solutions. We use our knowledge and practical experience to support customers in increasing maintenance intervals and reducing life cycle costs.

Manufacture and test

SKF has experienced application and service engineers to support customers and their SKF solutions. We maintain excellent manufacturing standards with quality control and quality assurance techniques. We also have dedicated railway test centres in China, Russia and Europe.

Install and commission

The SKF installation service offers excellent, comprehensive service from homologation to on-site mounting, including manuals and documentation and individual training.

Operate and monitor

SKF helps railway customers optimize performance with advanced condition monitoring solutions. This increases reliability and safety, and helps reduce maintenance costs, life cycle costs (LCC) and total cost of ownership (TCO).

Maintain and repair

Experienced SKF rail engineers provide expert maintenance and repair services on site and at our dedicated SKF Railway Service Centres. These services help provide total life cycle support for SKF products while reducing unplanned downtime and extending product life.

Expert services for rail

Services available from SKF for the railway industry include a global network of production, service and remanufacturing centres, all of them supported by a highly trained network of sales, application and service engineers.

Bearing relubrication

Specialists at SKF Railway Service Centres can clean and regrease sealed bearings, including using non-standard greases to satisfy special operating conditions. This service can also be conducted on site.

Bearing remanufacturing

SKF's expert bearing refurbishment and remanufacturing substantially contribute to life cycle cost optimization by providing:

- **Cost reduction compared to new bearings**
- **Extended service life**
- **Shorter lead times**
- **Contribution to environment sustainability by material and energy savings**

SKF professional refurbishment services for axlebox bearings are done in accordance with original specifications such as original equipment manufacturers (OEM) specifications and individual specifications of railway operators, which are based on the specific operating conditions.

Bearing investigation services

SKF provides bearing investigation and analysis services at its dedicated Railway Service Centres. This service can help clarify service issues and be used to check axle bearing condition to achieve vehicle mileage extensions and optimum bearing performance.

Bearing mounting and dismounting equipment

To help ensure easy, correct, damage-free mounting and dismounting of railway bearing units, SKF offers specially designed hydraulic presses and tools. SKF's unique hydraulic tool is ideal for disassembling railway axlebox spherical bearings. To remove inner rings of axlebox cylindrical bearings and to disassemble labyrinth rings, SKF offers special induction heaters, which are suitable for serial dismounting operations in railway workshops.

SKF also offers tools and equipment to optimise railway bearing lubrication. Based on a customer's requirements, SKF can package all the measurement tools needed to check journals and axleboxes during maintenance periods.

Bearing exchange

SKF offers an on-site bearing exchange service for customers operating railway vehicles on bearing units. Benefits of exchanging bearings on-site at a maintenance depot location include:

- **Vehicle quickly returned to service**
- **Inventory reduced by holding a reduced stock of spare wheel sets**
- **Exchanging bearings on-site costs a fraction of the replacement wheel set cost**

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PUB 42/P2 14920/1 EN · February 2018

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