

Services

Extract from the Railway technical handbook,
volume 1, chapter 10, page 182 to 195



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Services

SKF offers a first class range of services to the railway industry to meet customer's specific requirements. Most services are modular, and can be acquired to address a specific design or maintenance need. The SKF railway services comprise a worldwide network of production and service units as well as highly trained sales, application and service engineers. In addition, SKF has a global network of remanufacturing units for railway customers who benefit from solutions that are cost-effective and reduce environmental impact.

Service capabilities

SKF services help manufacturers and operators to achieve safety, excellent performance and life cycle cost expectations.

Some selected service capabilities are:

- unique testing resources to validate reliability and safety requirements (→ **chapter 3** and **chapter 4**)
- application engineering focused on specific customer specifications to achieve optimized solutions providing maximum customer value
- on-site service engineering, which includes mounting and a bearing or bearing unit replacement service. This service can significantly save on the cost of replacing wheelsets and helps to reduce downtime of vehicles
- remanufacturing options
- special training courses for customer's senior technical or project management staff as well as for shop floor staff to gain a deeper understanding about railway solutions which can help realize greater service life and utilization of bearings

Mounting

To achieve proper bearing performance and prevent premature failure, skill and cleanliness are necessary when storing and mounting bearings and bearing units. As precision components, rolling bearings should be handled carefully during mounting. It is also important to choose the appropriate method of mounting and to use the correct tools for the job.

SKF provides detailed mounting instructions for specific applications. These instructions are part of a comprehensive service package offered to the railway industry. Be sure to read the detailed mounting instructions in their entirety before mounting SKF bearings.

In this sub-chapter, only very generic advice is given. For further information, contact the nearest SKF office for on-site support from SKF service engineering or to obtain more detailed mounting instructions for specific applications.

Preparation

Proper care begins in storage. Store all bearings in their original unopened packages, in a dry place. The relative humidity should not exceed 60% and fluctuations in temperature should be avoided. The storage area should be clean and free of vibration.

The complete bearing designation is shown on the box or wrapping. Before packaging, the manufacturer protected the bearing with a rust preventive slush compound. An unopened package means continued protection. The bearings must be left in their original packages until immediately before mounting so that they will not be exposed to any contaminants, especially dirt. After removing the bearing from the original package, handle it with clean, dry hands and with clean rags. Put the bearing on clean paper and keep it covered.

Never place the bearing on a dirty bench or floor. Do not wash a new bearing – it is already clean. Normally, the preservative on new bearings does not need to be removed; it is only necessary to wipe off the outside cylindrical surface and bore.

Mounting location

Bearings should be mounted in a dry, dust-free room away from metalworking or other machines producing swarf and dust. When bearings have to be mounted in an unprotected area, steps need to be taken to protect the bearing and mounting position from contamination by dust, dirt and moisture until installation has been completed. This can be done by covering or wrapping the bearings, components etc. with waxed paper or foil.

Material needed

Before mounting, all the necessary parts, tools, equipment and data need to be at hand. It is also recommended that drawings and instructions are studied to determine the correct order in which to assemble the various components. Axlebox housings, shafts, seals and other components of the bearing arrangement need to be checked to make sure that they are clean, particularly any threaded holes, leads or grooves where remnants of previous machining operations might have collected. In some cases, the unmachined surfaces of cast housings need to be free of core sand and any burrs need to be removed. The dimensional and form accuracy of all components of the bearing arrangement need to be checked. The bearings will only perform satisfactorily if the associated components have the requisite accuracy and if the prescribed tolerances are adhered to.

Fitting practice

The inner ring bore and the outer ring outside diameter are manufactured within close limits to fit their respective supporting members – the journal and housing.



Safety advice!

Local safety and health rules apply when handling heavy bearings, axleboxes and components. Always wear protective gear such as safety shoes, gloves, helmet and goggles.

Mounting procedure

Before mounting the bearing, journals should be inspected in accordance with the instructions provided by the wheelset or bogie supplier.

When mounting the inner ring of a bearing directly on the journal, the press fit on the journal will expand the inner ring. After mounting, the internal clearance in the bearing is reduced. However, bearings are designed in such a way that if the recommended shaft fits are used and operating temperatures have been taken into account, the internal clearance remaining after mounting the bearing will be sufficient for proper operation.

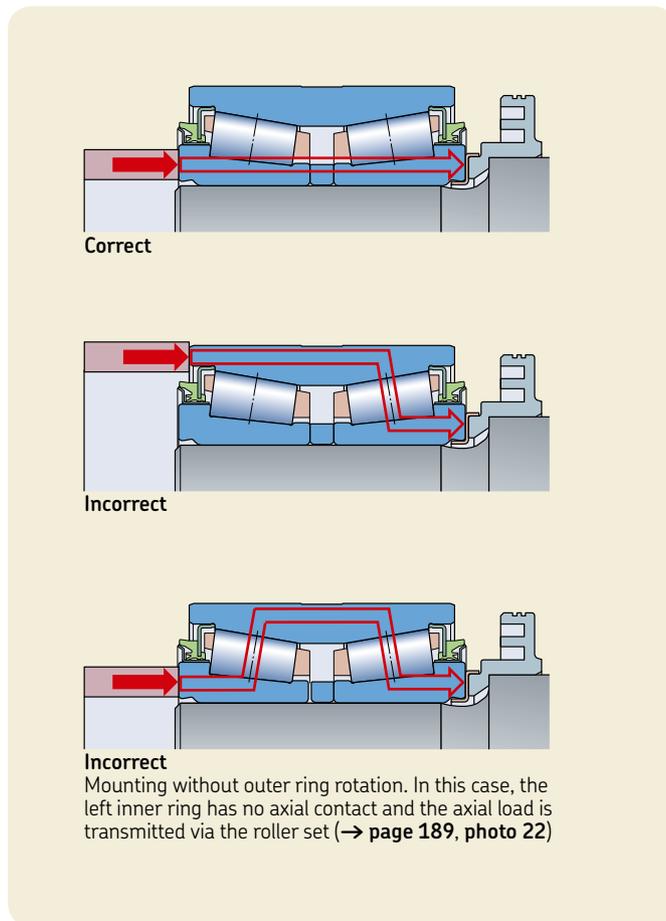
Depending on the bearing application, cold or hot mounting methods are used. In all cases, it is important that the bearing rings, cages and rolling elements or seals do not receive direct blows, and that the mounting force must never be directed through the rolling elements.

For proper bearing function, it is important that the correct mounting method and appropriate tools are used. Faulty mounting could easily destroy sensitive parts of the bearing such as raceways, rolling elements, cages, seals, impulse rings etc.

SKF axlebox bearings or units mounted onto the wheelsets, without the axlebox fitted, must be protected from the external environment and from shock loads. This is mostly done with a cylindrical protection sleeve made from a durable material such as plastic, covering the full length of the bearing from wheel to journal end. The protection must enable air circulation to avoid condensation.

Complete wheelsets must be protected from bad weather conditions and damaging agents. Bearings with contacting seals should preferably be stored in covered areas. Bearings with labyrinth seals should be stored in covered areas and, in all cases, with the final arrangement of the axlebox or with provisional protection supplied by SKF. Sealed plastic bags around the bearings or units should not be used as they promote condensation.

SKF bearings mounted on wheelsets with their axlebox fitted, must be stored in covered areas (possibly closed) and protected from bad weather conditions. To avoid possible standstill corrosion, wheelsets and bogies should be placed into service as soon as possible after mounting.



Cold mounting

The sealed and greased tapered and cylindrical roller bearing units must be cold mounted, i.e. pressed onto the journal without being heated. This can be done by using an SKF hydraulic press. Hydraulic equipment should be provided with a relief valve so that the specified pressure can be maintained for a short interval. To facilitate the correct mounting procedure, additional tooling, like pilot sleeve's, adapters etc., should be used.

Correct and incorrect cold mounting methods

Hot mounting

Hot mounting is only used for open bearings like cylindrical and spherical roller bearings and not for sealed and greased bearing units.

As the bearing cools, it contracts and tightly grips the shaft. It is important to heat the bearing uniformly and to regulate heat accurately.

Bearings should not be overheated, as excess heat can destroy a bearing's metallurgical properties, softening the steel and potentially changing its dimensions permanently. Detailed advice about the maximum heating temperature can be obtained from the SKF application engineering service.

Never heat a bearing using an open flame such as a blowtorch. Localized overheating must be avoided.

SKF induction heater

To heat bearings evenly, SKF induction heaters are recommended. The heating cycle can be controlled by checking the display of time or temperature. When the temperature of the bearing inner ring is measured, it is possible to set the heating temperature automatically. At the end of the heating cycle, the ring is automatically demagnetized.

Other heating methods

Hot oil baths have traditionally been used to heat bearings, but are not recommended because of health and safety considerations and environmental issues about oil handling and disposal. The risk of contamination of the bearing is also much higher.

Mounting axleboxes

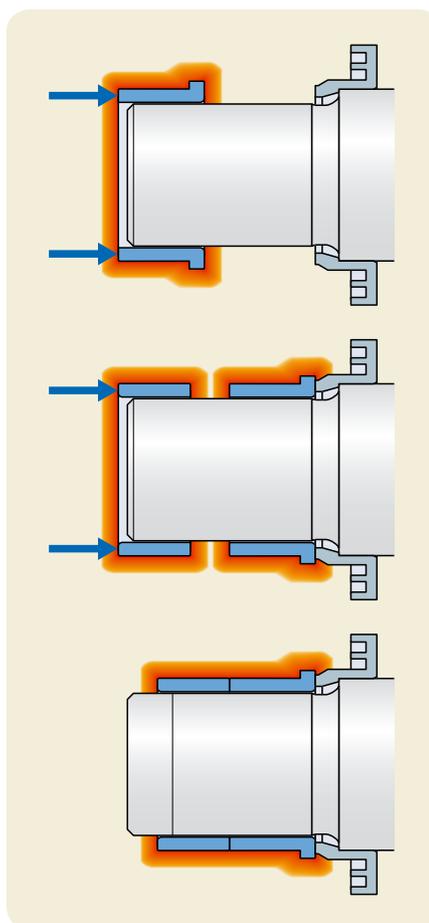
The mounting of the axlebox has to be done in accordance with specific instructions from bogie manufacturers and/or SKF.



*SKF induction heater
TIH 100m*



*SKF induction heater
TIH 100m
heating a bearing*



*Hot mounting of
bearing inner rings*

Mounting example

To give a brief overview, this example illustrates the main procedures (always read complete instructions before mounting). This series of photos is based on mounting a tapered roller bearing unit. SKF provides several on-site service engineering options, training courses for shop floor staff and detailed mounting instructions for specific applications.

1 Protected bearings inside the pallet box



2 Exposed bearings



3 Calibrating the measuring device, using a master



4 Cleaning the journal



5 Checking journal straightness with a ruler



6 Checking the journal temperature



7 Checking the bearing seat diameter, journal end, vertical position



8 Checking the bearing seat diameter, journal end, horizontal position



9 Checking the bearing seat diameter, journal middle, vertical position

10 Checking the bearing seat diameter, journal middle, horizontal position



15 Attaching the pilot sleeve



11 Checking the bearing seat diameter, journal inside, vertical position



16 Checking the alignment of the mounted pilot sleeve in three positions: 0°, 120° and 270°



12 Checking the bearing seat diameter, journal inside, horizontal position



17 Coating the journal with a thin layer of light oil prior to mounting



13 Checking the backing ring seat diameter, vertical position



18 Preparing to install the tapered roller bearing unit including the backing ring



14 Checking the backing ring seat diameter, horizontal position



19 Installing the tapered roller bearing unit on the pilot sleeve



20 Sliding the tapered roller bearing unit to the end position on the pilot sleeve



25 Tightening the end cap bolts



21 Preparing the TBU press



26 Bending the tabs of the locking plate



22 Pressing the TBU on its journal seat while rotating the outer ring by hand (→ page 185)



27 Installing the equipment to measure axial clearance in the tapered roller bearing unit



23 Removing the pilot sleeve



28 Measuring the axial clearance in the tapered roller bearing unit



24 Installing the end cap



Dismounting

As part of the mounting instructions, SKF provides detailed dismounting instructions for specific applications. These instructions are part of a comprehensive service package offered to the railway industry. Be sure to read the detailed dismounting instructions in their entirety before attempting to dismount a bearing.

In this sub-chapter only very generic advice can be given. For further information contact the nearest SKF office for on-site support from SKF service engineering or to obtain more detailed mounting instructions for specific applications.

Bearing units

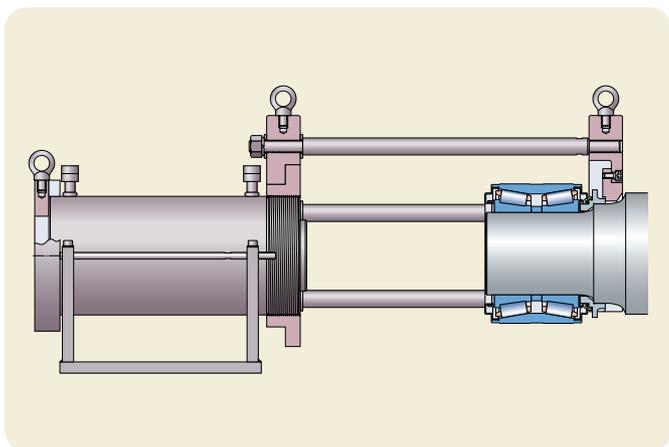
For tapered and cylindrical roller bearing units, the same SKF press can be used for mounting and dismounting. In addition to the mounting tools, specific tools for dismounting can be supplied.

Open bearings

To dismount open cylindrical or spherical roller bearings, different methods can be used.

Cylindrical roller bearings can be dismounted using special induction heaters. They heat up inner rings very quickly, so that they come loose from the journal seat and can be withdrawn.

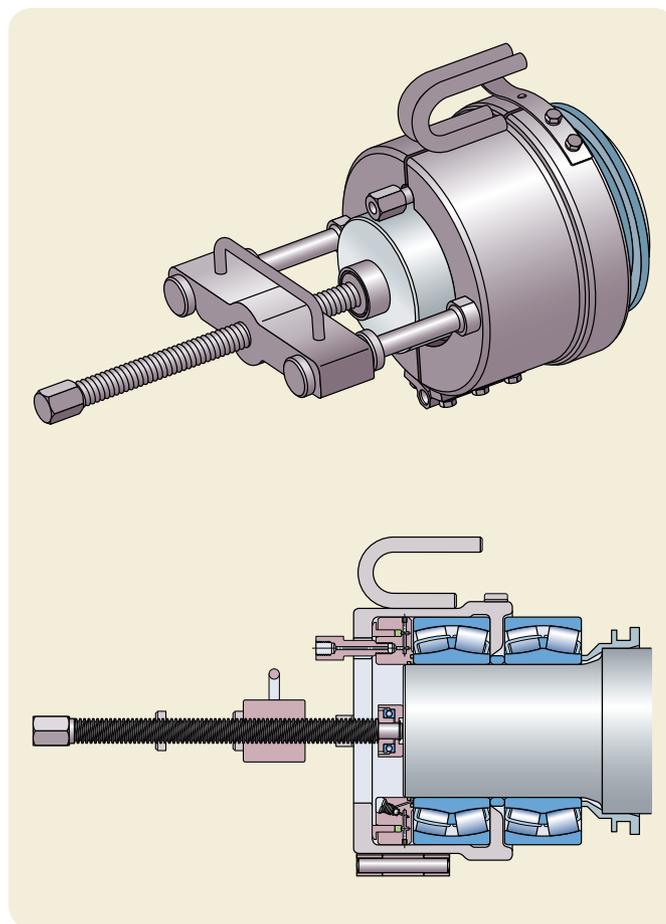
Dismounting a tapered roller bearing unit using a hydraulic press



SKF non-adjustable EAZ induction heater for dismounting inner rings of cylindrical roller bearings

To dismount spherical roller bearings from a journal seat, SKF supplies a dismounting tool that incorporates a special oil injection device. Oil is injected between the bearing inner ring and its journal seat. This forms an oil film that separates the surfaces and enables service personnel to remove the bearing with the incorporated puller.

Dismounting a spherical roller bearing from its journal seat using a special dismounting tool with an incorporated puller





Preparing for dismounting in the workshop



SKF service engineering offers special solutions such as bearing unit exchange without the need to dismount the bogie or wheelset



Adjusting the dismounting tool

Service engineering

SKF provides on-site service engineering, which includes a TBU exchange service. This can frequently save the cost of exchanging wheelsets.



Dismounting the tapered roller bearing unit with the TBU press

Remanufacturing

Capabilities

Bearing remanufacturing can result in a significant reduction in CO₂ emissions. Compared to the production of a new bearing, remanufacturing requires up to 90% less energy. By extending the service life of bearings, the process avoids the scrapping of many components and the unnecessary use of natural resources. In fact, remanufacturing a bearing that has a high percentage of service life left can provide substantial cost savings.

Remanufacturing is in many cases a teamwork between suppliers and customers. SKF can contribute greatly, thanks to its knowledge and experience in related matters such as diagnosis, lubrication, sealing, assembly, condition monitoring, bearing damage analysis and application engineering [38, 39, 40].

Principal options

In principle, remanufacturing is the process of disassembly and recovery at the component level. It can require the repair or replacement of worn out components. Parts subject to degradation which affect the performance or the expected life of the whole bearing system are replaced, like grease filling and contacting sealing systems. A remanufactured bearing or unit has to match the same customer expectations as a new one. There are quite different remanufacturing processes applied, depending on customer specification and location. For tapered roller bearing units:

- dismantling, cleaning, inspection, adjustment of the axial clearance by inserting a new defined inner ring spacer, greasing, mounting, documentation, logistic service, this process is used in Europe
- based on the process flow before and after inspection, polishing or minor partial regrinding of raceways can be applied if necessary, this process is used in North America
- a complete remachining of inner and outer ring raceways as well as new rollers, this process is used in China

Remanufacturing benefits

Bearing remanufacturing is a major contributing element to life cycle cost optimization.

- significant cost reduction compared to new axlebox bearings
- extended service life
- better availability, leading to stock reduction
- damage analysis and investigation of corrective actions
- increased performance capability by upgrading
- application feedback for improved operational and maintenance customer technology
- reduced environmental impact due to reduced waste, use of raw material and energy consumption

In addition to the overall term “remanufacturing” and “remachining”, which includes polishing and grinding operations, some railway operators and manufacturers are using the terms “reconditioning” and “refurbishment” as well to differentiate specific requests. However, it seems that there is no global definition for these terms and they overlap and can be contradictory. When ordering services, be careful you understand what will be provided, no matter what name is associated with it.

Specifications

The exact specifications to be used for remanufacturing have to be agreed upon with the customer. This can be based on:

- Association of American Railroads (AAR), Manual of Standards and Recommended Practices, Section H-Part II
- specification of the Ministry of Railways of the People’s Republic of China
- original equipment manufacturers’ (OEM) specifications
- SKF specifications for axlebox bearing or bearing unit remanufacturing
- individual specifications of railway operators and vehicle owners which are in the most cases based on one of the specifications mentioned above, plus additional requests with regard to specific operating conditions

SKF remanufacturing capabilities

Asia:

- Nankou (Beijing), China

Australia:

- Melbourne, Victoria
- Perth, Western Australia

Europe:

- Göteborg, Sweden
- Luton, UK
- Steyr, Austria
- Tver, Russia
- Pinerolo (Turin), Italy

Latin America:

- Bogota, Colombia

North America:

- Hanover, PA, USA

Service centres

SKF has many decades of experience in railway bearing remanufacturing. SKF offers to the railway industry a global network of specialized railway remanufacturing workshops. All work is performed at dedicated SKF remanufacturing service centres by specialists in accordance with rigorous SKF specifications and customer requirements. The remanufacturing service centres are located worldwide and cover most of the industrialized countries.

Process principle

Bearings that are not damaged beyond repair can be restored using appropriate procedures that can include polishing, grinding and component replacement. The applied remanufacturing process always has to meet individual customer's specification requirements.

Example

The process described below illustrates the remanufacturing principle and can deviate based on customer requirements. The remanufacturing process usually begins with the transportation of railway bearings/units from the wheelset workshops to the SKF remanufacturing service centres. For example, the tapered roller bearing unit consists of two inner ring assemblies (cone assemblies), the outer ring (cup), a spacer, backing ring and seal wear rings, excluding the end cap assembly and cap bolts. The unit is dismantled, the seals are discarded and the components are placed in an agitating wash system in which the lubricant is removed from the internal rolling components by a cleaning detergent. The components are coated with a rust preventive agent and are moved to holding locations.

As soon as ambient temperature is reached after washing, external surfaces of components, such as the outer ring, seal wear rings and backing rings, are buffed and polished to remove accumulated rust and other external material build-up. This process supports the inspection process. The components are inspected for visual and dimensional requirements. Components are scrapped when they do not meet specifications, or if it is not possible to rework to meet the individual customer's specifications.

Each bearing component is thoroughly inspected and measured for compliance to agreed specifications. These can be based on SKF or manufacturers specifications, or AAR Standards or even tighter customer specifications. Within the reconditioning process, it is imperative that each component is inspected in detail. Failure to uncover one abnormality could result in bearing failure while in service.

Inner ring assemblies and outer rings are visually inspected for wear and damage. This includes, for example, water or acidity damage (etching), or stain discolouration caused by acidity in the lubricant. Additionally, corrosion, pitting, rust, brinell

marks, metal smearing and peeling, marks from damaging current, heat discolouration, metal flaking, indentations, fatigue spalling, cracks and impact damage are included within the inspection. Each characteristic is detailed within the required specifications for conformance and non-conformance properties. Inner and outer ring components have the narrowest acceptable tolerance variations and are fully inspected before achieving full component certification.

Tapered roller bearing units (TBUs) have a lateral movement measured to very tight tolerances. A suitable spacer ring dimension is then applied. At this stage, the bearing unit will be staged in groups and processed to the lubrication area. New grease defined by the customer's specification is injected into the bearing by a pressurized lubrication device that evenly distributes the grease into the internal bearing components. For each bearing unit processed, the grease weight is measured for accuracy and is recorded to make sure that each bearing unit has a fully loaded lubrication charge and is ready for field service.

Once lubricated, the bearings are fitted with new seals and checked whether the seal retaining lip is properly seated in the outer ring seal groove.

Then, the bearing units are placed in a staging area, where staff cleans the external surfaces and fit the appropriate backing rings and seal wear rings to the finished product. New end caps, cap bolts and locking plates are added, if required. The completed TBUs then pass through a final inspection stage and are packed and shipped to the customer facility.

Universal polymer cage

One option to significantly improve reliability and safety of tapered roller bearing units is to upgrade them during the remanufacturing process by replacing the conventional steel cages with the SKF Universal Polymer Cages (UPC) (→ [page 81](#)).



Preparing bearing components for cleaning



Inspecting and recording



Inner and outer rings prepared for final inspection



Bearing assembly



Assembly line

Training

From bearing damage to asset management training, SKF provides a wide variety of training modules. SKF also offers training modules dedicated to the railway industry, either at the customer's facility or at SKF's facilities. The SKF training modules range from theoretical class room modules to hands-on workshops.

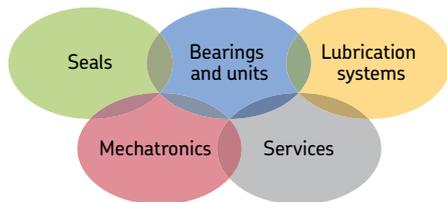
An example of a typical SKF training module for the railway industry is "Bearing damage". This is an example of a training programme that SKF provides to its British railway customers. A main topic of these courses is to train them on how to examine rolling bearings for damage, and how to understand the limits of acceptability of bearings in service and possible actions to avoid bearing damage:

- **One-day practical course**
complies with British railway standard TF/TT0025.
- **Bearing theory**
A module that provides participants with mandatory knowledge in accordance with British industry standard GM/RT2030. This module exists in 2 versions. One provides an appreciation of how participants' work can influence bearing operation on railway vehicles. The other one, more advanced, provides deeper knowledge in understanding the importance of lubrication, clearance and final checks when setting up a wheelset bearing assembly for railway service.

Training and assessment services

- competence assessments in bearing-related activities in accordance with industry standards
- practical and theoretical training in bearing subjects in accordance with industry standards
- tailor-made training in bearing-related matters
- training in bearing damage and examination techniques
- quality audits of industry bearing facilities, products and services, accredited to ISO 9001, ISO 14001, OHSAS 18001 and IRIS. Audited by major UK rail companies.





The Power of Knowledge Engineering

Drawing on five areas of competence and application-specific expertise amassed over more than 100 years, SKF brings innovative solutions to OEMs and production facilities in every major industry worldwide. These five competence areas include bearings and units, seals, lubrication systems, mechatronics (combining mechanics and electronics into intelligent systems), and a wide range of services, from 3-D computer modelling to advanced condition monitoring and reliability and asset management systems. A global presence provides SKF customers uniform quality standards and worldwide product availability.

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