

# Gearbox remanufacturing services from SKF

Make your gearbox perform as new – or even better





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## Maximize gearbox availability and reduce life cycle costs

The reliability of industrial gearboxes is constantly challenged by shock loads, vibrations and increased utilization of available torque. Added to these conditions are ever-changing production volume demands and difficult, time-consuming maintenance procedures.

Given these conditions, achieving availability targets is no easy task. But by addressing root causes, rather than symptoms, you can significantly increase the reliability and availability of your gearboxes and reduce gearbox life cycle costs. For this reason, SKF always performs a detailed root cause failure analysis (RCFA) on bearings, seals and gears in order to determine what caused the failure.

## A systems approach to problem solving for improved gearbox performance

SKF takes a systems approach to gearbox refurbishment, drawing on our knowledge developed from designing bearing systems for all types of rotating equipment for many OEMs, as well as from our expertise in bearings, gears, seals and lubrication.

With the use of proprietary modelling and simulation software that serves as a virtual test rig, SKF engineers are able to view the complex interrelationship of components under real-world conditions. Frequently, this enables a gearbox to be not only refurbished but upgraded with increased power and output torque, higher service factor or extended mean time between failures (MTBF).

A 360° service provider, SKF can not only diagnose a problem but design and deliver the right technical solution to eliminate it. SKF gearbox remanufacturing services can help to provide a long and trouble-free service life. In many cases, SKF refurbished gearboxes perform better than when they were new.



*The correct timing for removal and remanufacturing of gearboxes is essential for achieving an optimal balance between the longest gearbox service life and lowest operating costs. SKF predictive maintenance technologies and services enable you to know the status of your machinery at all times, so you can optimize the timing for gearbox removal and remanufacturing and achieve maximum asset availability.*

### **An independent resource**

*Because SKF is not a gearbox manufacturer but an independent company, we are able to objectively assess conditions inside and outside the warranty period offered by the gearbox manufacturer. An objective evaluation can reveal inherent problems with gearbox design, which can be corrected with design improvements and upgrades during the rebuilding process.*



*Shown here is the same gearbox, before and after a total refurbishment by SKF gearbox specialists at one of our Gearbox Remanufacturing Centres.*



## Understanding and correcting the causes of gearbox failure

### Root cause failure analysis (RCFA)

Because understanding the problem that caused the failure or unplanned stop is critical, SKF service engineers conduct a root cause failure analysis (RCFA).

Applying bearing and gear and failure modes expertise, SKF can provide complete machine on-site assessment based on vibration analysis combined with a visual inspection, vibration spectra acquisition, endoscopy, thermography and oil analysis. The RCFA can pinpoint the cause of gearbox failure and enable SKF to determine the right technical solution to eliminate recurrence of the problem.



### Advanced engineering services

SKF gearbox specialists can evaluate an existing design including bearing and seal arrangements and gear pairs, then use SKF Simulator and KISSsoft engineering softwares to redesign the entire gearbox. We can also review and upgrade the lubrication system as well as the coupling selection, offering engineering upgrades and related products or spares. Reverse engineering is also possible when manufacturing drawings are no longer available.

### World-class components

During refurbishment and upgrade, bearings and seals are always replaced with high quality spares, in many cases resulting in an improvement over the gearbox's original performance. Customers benefit from the superior quality and performance of SKF Explorer class bearings, high performance seal designs and materials, as well as the short delivery times made possible by SKF's world-class global distribution network.

### Global uniformity

SKF has invested significantly in process standardization and quality standards to ensure uniform procedures during reconditioning at all of our Gearbox Remanufacturing Centres. These centres are within the global SKF Solution Factory network and can deliver these services uniformly in every part of the world, an important factor for multinational companies that require uniform standards worldwide. These centres offer the agility and flexibility of a small company, but with the capacity, core competencies, and peace of mind that only a large industry leader can deliver.



## A wide portfolio of on-site and workshop services

With SKF you can rely on the knowledge, tools and solutions to optimize each phase of the gearbox life cycle. We provide a full range of remanufacturing services for any type or brand of gearbox on-site or off-site at one of our Gearbox Remanufacturing Centres which are available as part of the global SKF Solution Factory network.

### On-site inspections and diagnosis

SKF service engineers are equipped with the right tools and competencies to make expert gearbox assessments at the customer's location. They visually inspect the machine, analyzing gear flanks and bearing and seal status where possible. This, combined with a vibration acquisition and oil analysis, creates a complete picture that enables SKF service engineers to draw conclusions on the gearbox conditions. The on-site inspection therefore becomes a complete value-added diagnosis for the gearbox owner or user.

Once the gearbox arrives at one of our Gearbox Remanufacturing Centres, we can offer you a complete reconditioning process and, where possible or required, we can upgrade your machine.

### Disassembly and conditions assessment

This process includes preliminary disassembly, cleaning, inspection and analysis of critical components such as gears, bearings, shafts and seals. Bearing seat measurements and geometry checks are also done. A non-destructive test is always performed on parts such as shafts or gears that are supposed to be re-used.

### Refurbishment

This is the complete machine renovation, where all bearings and seals are replaced with premium quality SKF spare parts. Gears are analysed and reworked or replaced according to the flank status or presence of cracks. Housing seats are reworked if necessary. The gearbox is assembled, adjusting the operating bearing's axial and radial clearances and gear's backlash.

### Upgrades

This service takes refurbishment to the next level with upgrades to improve gearbox performance. Following assessment and complete machine reconditioning, the design is verified and reviewed with a goal of improving the gearbox system. Improvements can touch on output torque or service factor or extend the life of the whole system. The gearbox's lubrication system is enhanced to match the new performance level.

### Final testing

Null load testing is done on refurbishment and upgrades, rotating the gearbox at the nominal rotational speed and monitoring the temperature progression. During the test, the gearbox runs with dedicated oil until the required contamination level is reached. An oil particle counting device stops the testing procedure. Only gearboxes with a very low level of residual particles will leave the workshop! An advanced vibration acquisition concludes the process.

### Commissioning

Whatever service you selected, you can rely on SKF to properly install and start up your reconditioned unit. On request, our service engineers are able to align the gearbox to the electric motor, and perform the first start-up. Under nominal working conditions (load, speed and temperature), a vibration acquisition could be done to set the base for future comparisons. SKF Remote Diagnostic Services are the best way to keep your reconditioned unit continuously monitored.





## High quality service and spares, worldwide

### Gears

Hardened or case-carburized gears are used as spares. They are manufactured from high quality steel by homologated suppliers that have passed rigorous SKF certification processes and are capable of producing gears up to ISO 6 (AGMA 10) as grade of accuracy, or better. Gear design verification, and eventually upgrade, is done when a new gear pair is manufactured.

Reverse engineering is implemented every time there is the need to produce gears when drawings and original technical specifications are not available.

### Bearings

The bearing execution, the type of rolling elements, the internal clearance and the cage type can definitely influence the performance of bearings in high speed shafts where the challenge is to resist smearing and heat development. SKF expertise helps to ensure the right bearing in the right gearbox position.



New upgraded SKF Explorer self-aligning roller bearings ensure longer service life under poor lubrication or contaminated conditions that could be found in the gearbox low speed shafts. And new SKF high capacity cylindrical roller bearings and all the SKF explorer executions have higher carrying capacity to perform better under the heavily loaded conditions of intermediate shafts.

### SKF industrial power transmission sealing solutions

SKF offers an array of proven shaft sealing solutions to protect the reliability of gearboxes.



Available in diverse designs and materials, SKF radial shaft seals include many that follow ISO, ASTM, or DIN standards. SKF's full range of rubber outside diameter shaft seals with trimmed lips are made with a proprietary compound

that is specifically formulated to resist aggressive gearbox oils. SKF metal outside diameter shaft seals feature the SKF Wave lip design, which reduces friction compared to conventional straight edge radial lip seals.

V-ring seals from SKF offer an easy-to-install solution for rotating shaft applications, including use as a secondary seal in highly contaminated environments. They are manufactured with a proprietary NBR and FKM rubber material.

Over time, particles can become trapped underneath a shaft sealing lip. Grooves begin to form on the shaft, eventually leading to system failure and shaft damage. Repairs usually involve dismantling and re-machining the shaft. SKF Speedi-Sleeve offers a much faster, more cost-effective alternative. It is a thin-walled shaft sleeve that is pressed into position over the shaft to provide an excellent counterface for radial shaft seals, often better than what can typically be achieved on a shaft.



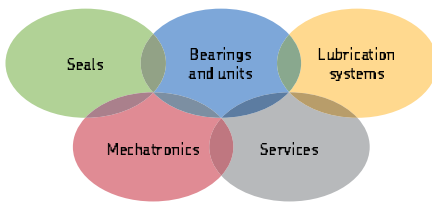
The combination of SKF Speedi-Sleeve with radial shaft seals and V-rings help to provide greater uptime, improving the productivity and reliability of gearboxes.



### Machined seals concept

The machined seals concept provides a fast, flexible alternative to high volume moulded seal production. With a unique combination of capabilities, SKF can deliver polymer seals using a very short time, in virtually any dimension and any design using SKF propriety high performing materials formulated for seal functioning.

*See inserts for more details about SKF solutions for gearbox remanufacturing.*



### The Power of Knowledge Engineering

Combining products, people, and application-specific knowledge, SKF delivers innovative solutions to equipment manufacturers and production facilities in every major industry worldwide. Having expertise in multiple competence areas supports SKF Life Cycle Management, a proven approach to improving equipment reliability, optimizing operational and energy efficiency and reducing total cost of ownership.

These competence areas include bearings and units, seals, lubrication systems, mechatronics, and a wide range of services, from 3-D computer modelling to cloud-based condition monitoring and asset management services.

SKF's global footprint provides SKF customers with uniform quality standards and worldwide product availability. Our local presence provides direct access to the experience, knowledge and ingenuity of SKF people.

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