



# Sealing solutions from SKF

Customized for your system performance



The Power of Knowledge Engineering



How can we protect your applications and



# your business?

*Seals have a crucial impact on system performance. Service life and reliability of what is often considered a simple component can make all the difference to your products and operations. SKF has more than 100 years of experience in various industries and application, and is the only company that can support key aspects of the sealing system through its knowledge of bearings, seals, lubrication and associated science and technology. SKF offers expert advice and provides support throughout the life cycle of your sealing system.*

## Empowering your business

At SKF we value your business. Our comprehensive knowledge and experience across almost every industry sector and key applications allows us to customize a solution for you. SKF's advanced research and development in sealing technology – material, design and tribology – results in solutions that increase your system productivity and enhance your technological solutions.



## Combined offer

You can take advantage of our knowledge in integrating technologies and customizing solutions in the areas of bearings, seals, services, mechatronics and lubrication systems. Understanding the challenges from the beginning, whether in the development of a new system or in a maintenance solution, results in a proven offer that bundles our knowledge. This is built on years of experience working in direct contact with industry leaders and continuously expanded through research and cooperation with leading universities and technical centres.



## Global availability

At SKF, we have the commitment and global resources to support the unique requirements of your operations. With a presence in more than 130 countries, we offer sealing solutions for rotating and reciprocating applications from prototype to serial production.



A range of services including seal analysis, testing, installation assistance and training completes our offering. With SKF, you can rely on receiving application engineering and aftermarket support wherever your machine operates.

## Sustainability at work

When you partner with SKF, you do both the environment and the workplace a favour. SKF sealing systems are designed to protect your system from outside contaminants and to reduce lubrication leakage from the machinery into the environment. Reduced friction also reduces energy consumption and CO<sub>2</sub> emissions. You can rely on an SKF solution to contribute to a safer, healthier environment.





# One source for different applications

*Sealing solutions from SKF encompass a comprehensive, globally available portfolio of seal products and services for all industries, from low friction engine shaft seals for the automotive industry to hydraulic cylinder seals used in fluid power applications, all with SKF's high level of quality and reliability.*

## Seals for automotive and transportation

SKF is a leading manufacturer of seals for the transportation industry and offers a wide spectrum of advanced sealing solutions for cars, light vehicles, trucks, buses, two-wheelers and railways.



As a specialist in both bearings and seals, SKF is able to combine these products and their functions in high-performance units, providing a unique advantage. An example of this is the magnetic trigger wheel in integrated sealing units used in car wheel hubs and engine controls. The trigger wheel emits an extremely accurate magnetic signal that provides information on rotational speed, direction of rotation, angular position and acceleration or deceleration, thus improving the overall efficiency of the application.

SKF also offers sealing solution for railways, such as seals used in tapered bearing units for railway freight cars. Indeed, in 2010, SKF received the single largest order for seals awarded by the Indian Railways to any individual supplier for seals.

## Seals for aerospace

For the aerospace market, SKF provides radial lip shaft seals for rotor systems, engines, gearboxes, transmissions, auxiliary power units, etc. SKF's seal knowledge is also applied to develop and sell precision elastomeric devices, which are produced by layering elastomers between metallic shims of substrates. This custom designed product has the ability to carry heavy loads while absorbing, dampening and/or controlling large deflections occurring simultaneously in several directions, which makes it particularly appropriate for use in helicopters.

SKF's dynamic seals portfolio includes products for the powertrain (engines and transmissions), chassis and wheel-end applications.

High pressure valve stem seals, SKF Low Friction Bonded Piston Seals and SKF Low Friction Engine Seals represent some of the recent innovations that help to reduce fuel consumption and CO<sub>2</sub> emissions to meet customer needs and regulatory demands.

These complement long-established products such as SKF Scotseals for heavy duty wheel-ends which offers easy maintenance and long life, or SKF Rotostat, an easy-to-install sealing module that combines an engine crankshaft seal and a static seal into one unit that can also be equipped with sensors to provide shaft rotation information.



## Industrial seals for power transmission

Industrial seals offered by SKF encompass the broad sectors of power transmission and fluid power. SKF's focus is on dynamic seals where the sealing function is important as well as friction management.

The performance and service life of your power transmission arrangement is directly related to the sealing solution. SKF's offerings of sealing solutions support virtually every industrial sector and application, from very small, high-speed machine tools to rolling mills in heavy industry.

Examples of our offerings include the range of metric rubber outer diameter shaft seals, with materials designed to be specifically compatible with aggressive gearbox oils which set a new benchmark in the industry. For the off-highway industry, SKF offers undercarriage sealing solutions including SKF Mudblock cassette seals, kingpin seals, transmission seals, and the innovative SKF Trackstar seals for tracked machinery.

Large diameter seals that can be welded on-site help our customers to reduce installation time, fitting costs and plant downtime. SKF combines its expertise in bearings and seals to offer high-performance units, such as SKF Nautilus bearing unit for wind turbines, which features a highly effective seal designed to protect the bearing while retaining the lubricant.

Besides seals, SKF offers solutions to protect shafts through its SKF SPEEDI-SLEEVE range, which provides a seal counter-face helping to reduce downtime and enhancing sealing system performance.

## Industrial seals for fluid power and fluid handling

Sealing solutions for fluid power applications such as hydraulic cylinders have to satisfy the demands of extreme operating conditions and power density, which in turn places a high demand on seal design and material development. SKF materials are proprietary formulations that provide excellent chemical compatibility with various hydraulic fluids.



SKF offers both standard and customized solutions for fluid power applications. These include wiper seals, rod seals, guide rings, piston seals, static seals and rotary manifold seals. Sealing solutions are also offered for linear actuators with shock loads working in a wide temperature range. Buffer seals and high strength anti-extrusion rings accommodate the high pressure peaks induced in applications.

Sealing solutions for fluid handling applications may need to operate in contact with various types of fluids or slurries, some of which require stringent regulatory compliance. SKF's offerings includes metal spring loaded seals and metal encased PTFE seals. These seals meet industry demands, such as those in the oil and gas industry or the food and beverage industry which requires FDA approved materials.

Our sealing solutions can be customized in a wide range of configurations, materials and spring elements.



# A “real life experience”

*The design and development of material, product and process, combined with testing and failure analysis, are vital elements for successful seal development – each of which can result in the difference between poor, adequate or exceptional product performance. SKF combines these elements with its expertise in various applications, to offer solutions that are based on an understanding of sealing systems under real conditions.*

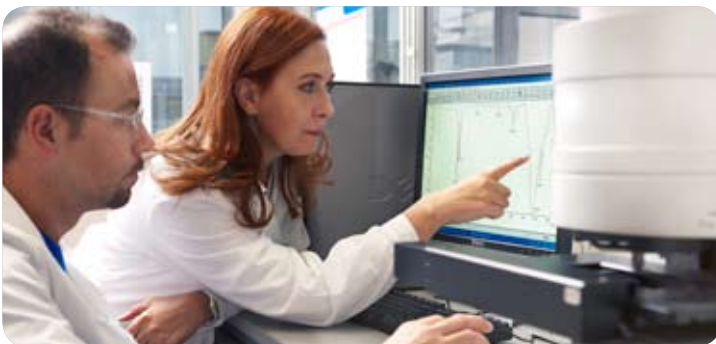
## Materials

One of the most critical elements in sealing technology is the selection of suitable materials to address challenging tasks. Seals must resist increasingly high temperatures, forces and pressures. Specific media and lubricant properties must also be considered. Some media require stringent regulatory compliance, such as for food and beverage applications, while in other cases new generation bio-degradable hydraulic fluids or alternative fuels for automotive applications require special consideration.

SKF has the capability to design seals in a wide range of materials across elastomers, polyurethane, thermoplastics and speciality materials. Proprietary materials provide the right solution for various applications. ECOPUR is a thermoplastic polyurethane (TPU) material which has an unusually high abrasive resistance, low compression set, high physical properties and tear strength

which makes it especially suitable for use in hydraulic applications. SKF Duratemp is a hydrogenated nitrile rubber (HNBR) able to withstand abrasive environments and high temperatures in heavy duty industrial applications. Newly developed materials include a fluorocarbon elastomer capable of operating in  $-30\text{ }^{\circ}\text{C}$  and other elastomers that provide lower friction in automotive applications.

In addition to materials, coatings play an important role, whether to accommodate small imperfections in the housing bore surface, like SKF Bore Tite Coating does, or to increase durability, like the metallic coating used in SKF SPEEDI-SLEEVE Gold version. SKF works in close partnership with its customers to understand specific requirements so that the appropriate material is developed.





## Testing and analysis

The optimization of products, system solutions and services is a continuous, systematic process which includes extensive state-of-the-art testing procedures performed with the utmost care. Data from thousands of seal tests conducted annually are fed into SKF's database providing valuable know-how, and a broad empirical knowledge base for failure analyses, benchmarks, and a consistent flow of new products and innovative solutions.

The range of testing includes durability, contaminant exclusion, salt fog corrosion, cold fracture, pump rate, friction torque, dry wear, and material compatibility tests. SKF can also rely on test rigs developed for specific applications designed to simulate real working conditions of the product mounted in the actual customer application.

Tests for dynamic applications are continuously monitored to verify parameters such as under lip temperature, friction force, oil leakage and a host of other test conditions. Samples are analyzed to characterize failure modes using state-of-the-art instrumentation.

Finite Elements Analysis (FEA) provides SKF developers with a tool to perform simulations of almost any operating condition using different seal geometries to identify the critical areas in the seal design. This allows SKF to consistently develop new solutions for any kind of industry and application.

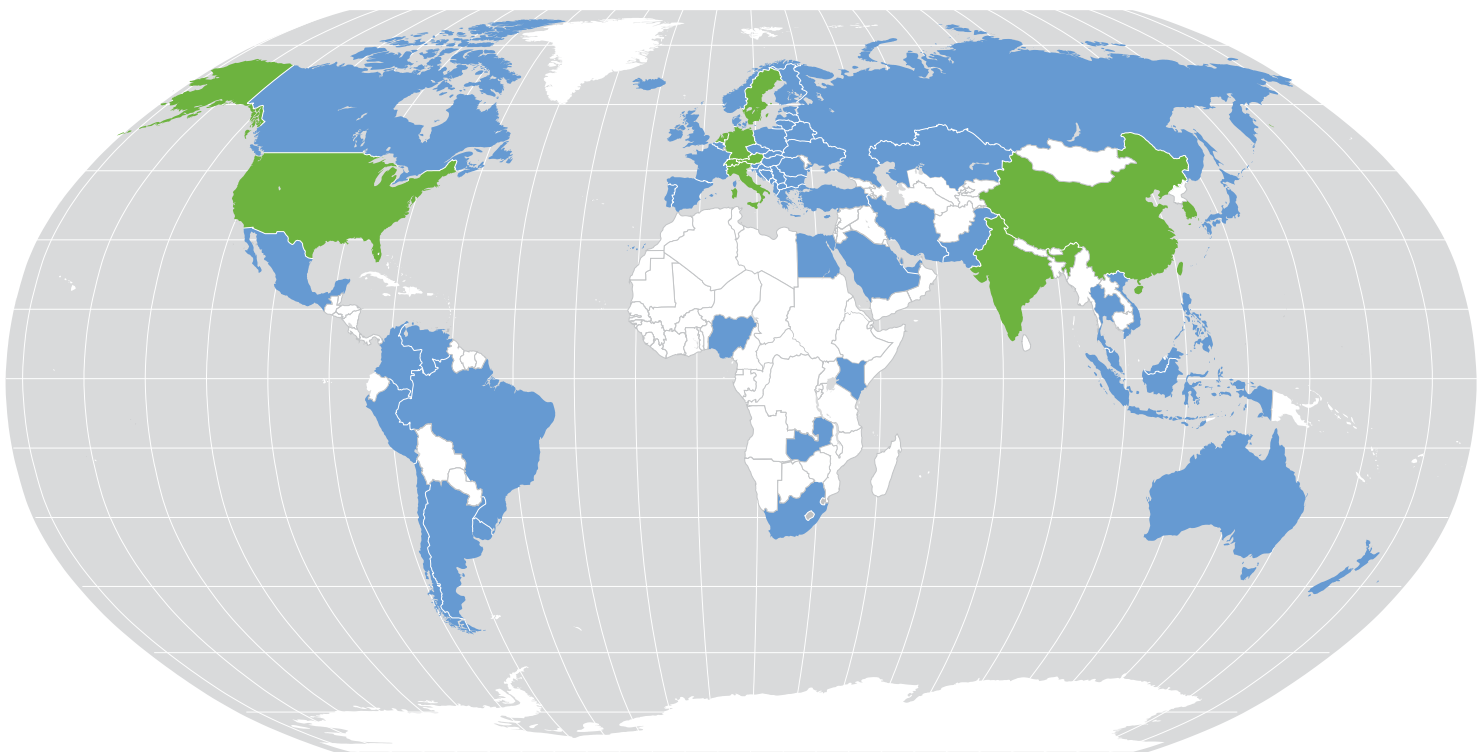
SKF has a global network of testing facilities to analyze the different variables in which the seal is operating. SKF laboratories are equipped with both static and pulsating high-pressure test rigs capable of generating pressures up to 3 000 bar and temperature extremes from  $-40^{\circ}$  to  $150^{\circ}\text{C}$ . Facilities include a clean room testing facility that meets the requirements of medical technology.

## System knowledge

The combination of our expertise in seals, bearings and mechatronics with application knowledge provides us with a deep understanding of the system in which the seal will operate.

In designing solutions, SKF engineers also benefit from a proprietary and newly designed software which has been developed to describe and characterize the non-linear behaviour of sealing materials which helps to predict sealing performance under a variety of conditions.

Countries with SKF seals dedicated R&D and testing units





# The proximity and flexibility you can

*SKF has a global presence and works closely together with the customer. The global presence of our sales organization enables us to gain a faster and better understanding of the complex requirements coming from the different markets. SKF's global production facilities and technology provide the necessary flexibility for a fast response and short delivery time to the customer.*

## Working side by side

SKF offers sealing solutions customized for your needs, with a working partnership from the design phase to serial production and maintenance needs. Innovative processes and a Design for Six Sigma approach enable SKF to reduce the time to market of our solutions.

SKF has dedicated sales, engineering and customer service teams in every market globally. This makes us closer to customers and their technical centres, to better respond to needs and requirements across organizations and markets.

Thanks to our efficient logistic services, distributors and dealers network and production sites worldwide, SKF is closer to customers than many other manufacturers.

SKF also has Solution Factories in all major regions that brings together all combined solutions that SKF can offer to meet your needs.

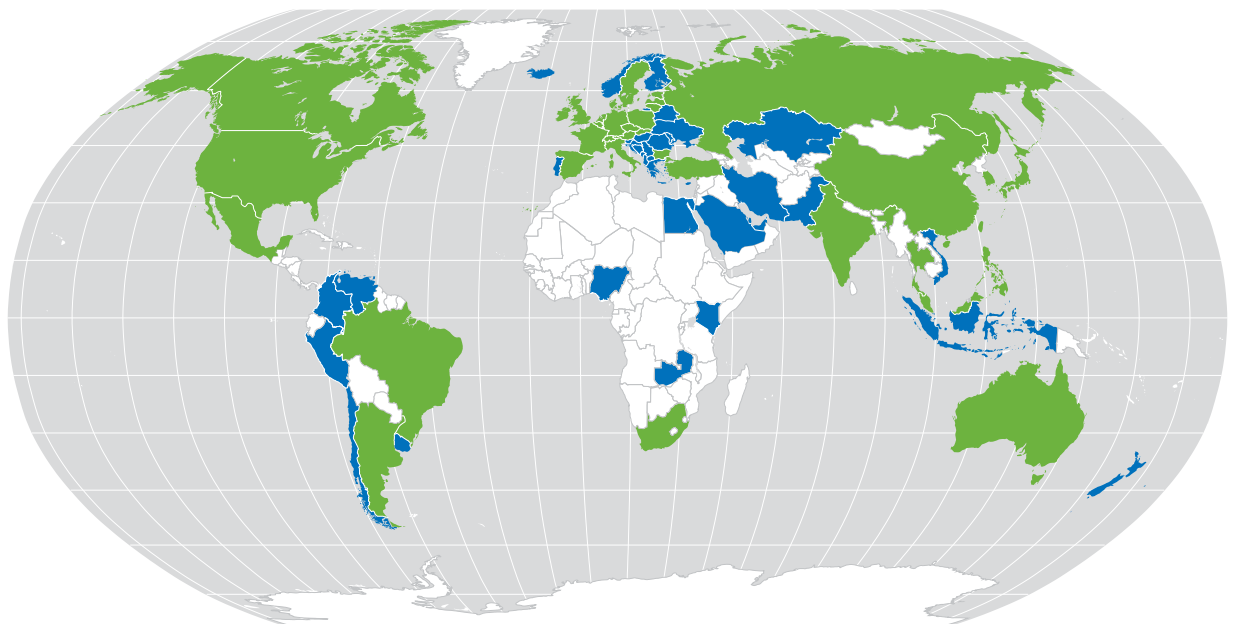
Experienced people at SKF make all the difference through their professionalism and dedication to serve every customer.



■ Countries with SKF seals moulding and/or machining facilities, engineering, sales and customer service units

■ Countries with SKF sales, engineering and customer services units

□ In most of the countries in white SKF is represented through authorized distributors/dealers







# count on

## Manufacturing flexibility

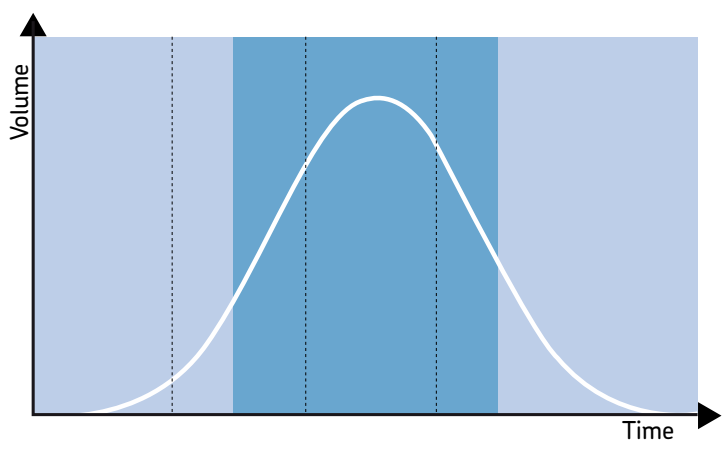
The unique SKF production model can respond quickly to your supply needs, whether large volumes are required or a single seal for a range of standard or custom applications.

Molded seals production technology allows for cost-effective production of seals in high volumes. SKF has competency in compression, injection and transfer molding technologies and the appropriate method will be used to meet your requirements.

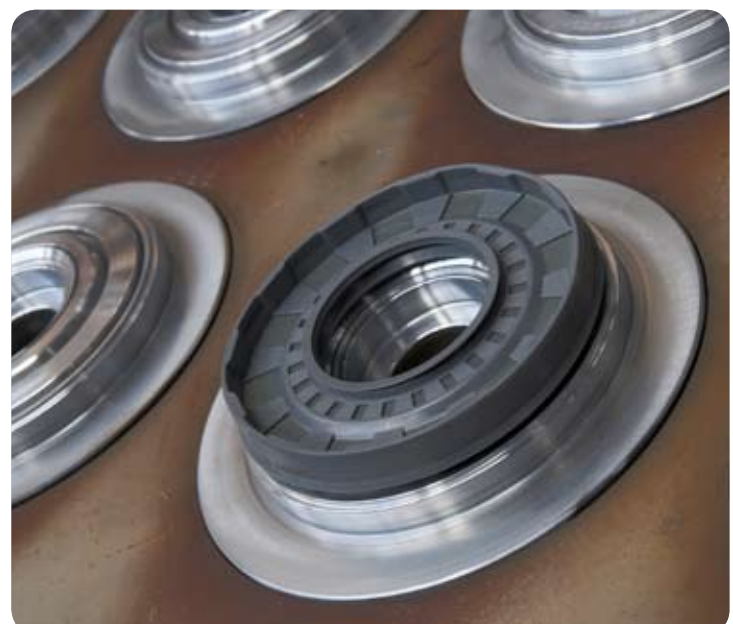
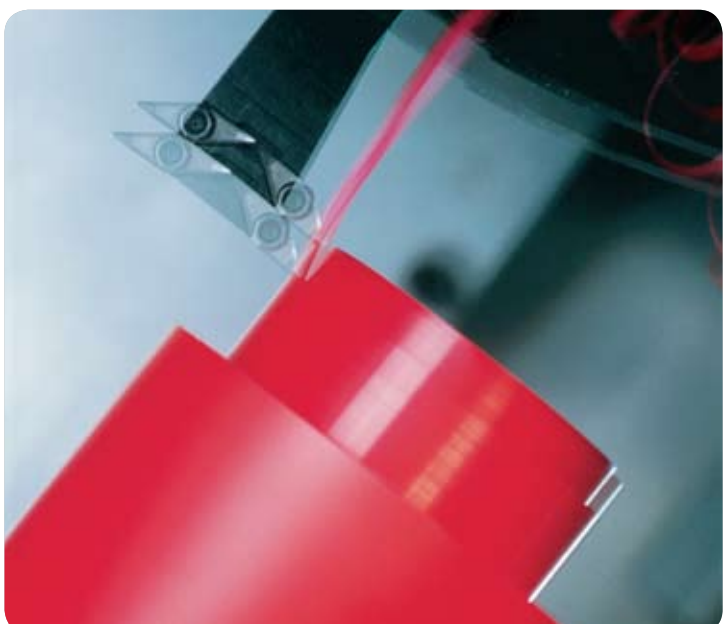
Large diameter seals are produced from elastomers or polyurethanes. We can produce many seal designs, such as metal-cased seals, rubber outside diameter seals with metal inserts, fabric-reinforced as well as all-rubber types that allow customizing the large diameter seals according to the industry's requirement. One of the specialties is the polyurethane based seal which can be installed on site to reduce downtime.

SKF SEAL JET technology, used to manufacture machined seals, is based on proprietary software and special tools developed by SKF for machining different polymers, especially polyurethanes. Without any tooling costs, it enables fast and flexible production of prototypes for innovative applications, low-volume series or replacement seals.

Product life cycle stages



- Machined seals  
 To cost effectively produce prototypes and seals in low volumes with short delivery time (in the introduction, initial growth, declining phase and to meet replacement demand).
- Moulded seals  
 To cost effectively produce seals in high volumes (in the growth and maturity phase)





# At home in any industry

*SKF takes a system approach to bearing and seal design and together with its wide selection of materials and designs can help customers to improve their product performance and provide a competitive edge in the marketplace. Sealing solutions from SKF are at home in any industry, providing superior performance and competitive advantages.*



*Cars*



*Railways*



*Mining, mineral processing and cement*



*Trucks*



*Off highway vehicles*



*Gearbox*



*Two wheelers*



*Oil and gas*



*Hot rolls mill in a steel plant*



*Aerospace*



*Food and beverage*

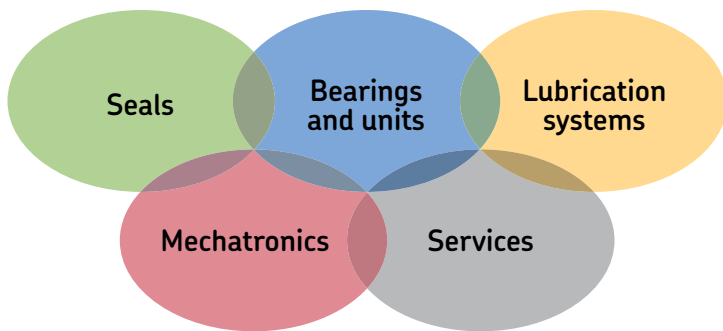


*Wind energy*

*See inserts for more details  
about sealing solutions from SKF*

The Power of Knowledge Engineering





### 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 services. A global presence provides SKF customers uniform quality standards and worldwide product availability.

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