

your global specialist

Lube & Seal[®] for Power Transmission Engineering

Enhanced and prolonged sealing with Klüber Lubrication
and Freudenberg Sealing Technologies.





| | |
|--|----|
| Lube&Seal: Two worlds coming together | 3 |
| Lube&Seal: Small investment – great result | 4 |
| High requirements in power transmission engineering | 6 |
| Lube&Seal: The solution from Klüber Lubrication and Freudenberg Sealing Technologies | 7 |
| Lube&Seal – and this is how you benefit | 8 |
| Development | 9 |
| Testing | 10 |
| Test results | 10 |

Lube & Seal: Two worlds coming together

Welcome to Freudenberg

Over many years, Freudenberg has made its mark as a leading specialist in the sealing technology sector and in the area of chemical specialties, such as lubricants and release agents. The Freudenberg Group is an internationally successful, customer-oriented and innovative family-owned company whose extensive product portfolio is complemented by over 150 years of experience. www.freudenberg.com

Freudenberg Sealing Technologies is a global specialist for sealing technology. Through continuous innovation, the broadest product range, unique competence in materials and a multitude of integrated services, Freudenberg Sealing Technologies has become the world market leader in sealing technology. www.fst.com

Klüber Lubrication, a company of the Freudenberg Chemical Specialties business group, offers over 1,500 different special lubricants for a wide variety of applications and markets. Whether you work with highly loaded gearboxes, food-safe oils or greases, high or low temperature resistant or biodegradable lubricants: We are there to help you with our over 80 years of experience! www.klueber.com

Sealing specialist meets lubricant expert – simmerring seal meets lubricant: It seems a logical conclusion to coordinate these two worlds and their chemical formulations. Our in depth knowledge of the interaction between elastomers and lubricants enables us to develop long-lasting, reliable radial shaft seals for use in power transmission engineering.

Freudenberg Sealing Technologies and Klüber Lubrication have combined their core competences. The result is Lube&Seal, a unique service with innovative products for optimizing your sealing systems in power transmission engineering.

Lube&Seal – benefit from well-founded know-how and innovative ideas from a single source!

Lube&Seal provides comprehensive know-how for the optimization of sealing systems in power transmission engineering.

And this is how you benefit:

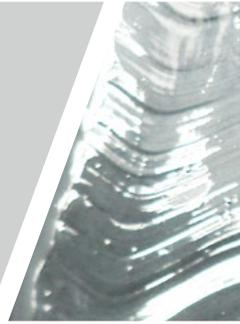
- cost savings of up to 25 % thanks to prolonged service life
- safeguarding of warranties against end user claims
- increased customer satisfaction due to reduced failure rates
- competitive edge through your “Lube&Seal certified” sealing system
- your needs and requirements taken care of by the Freudenberg Group
- enhanced competence from our supportive consultation during complaints procedures and analyses

Just contact us to find out how Lube&Seal may assist you in achieving your goals.

We are there to advise you!



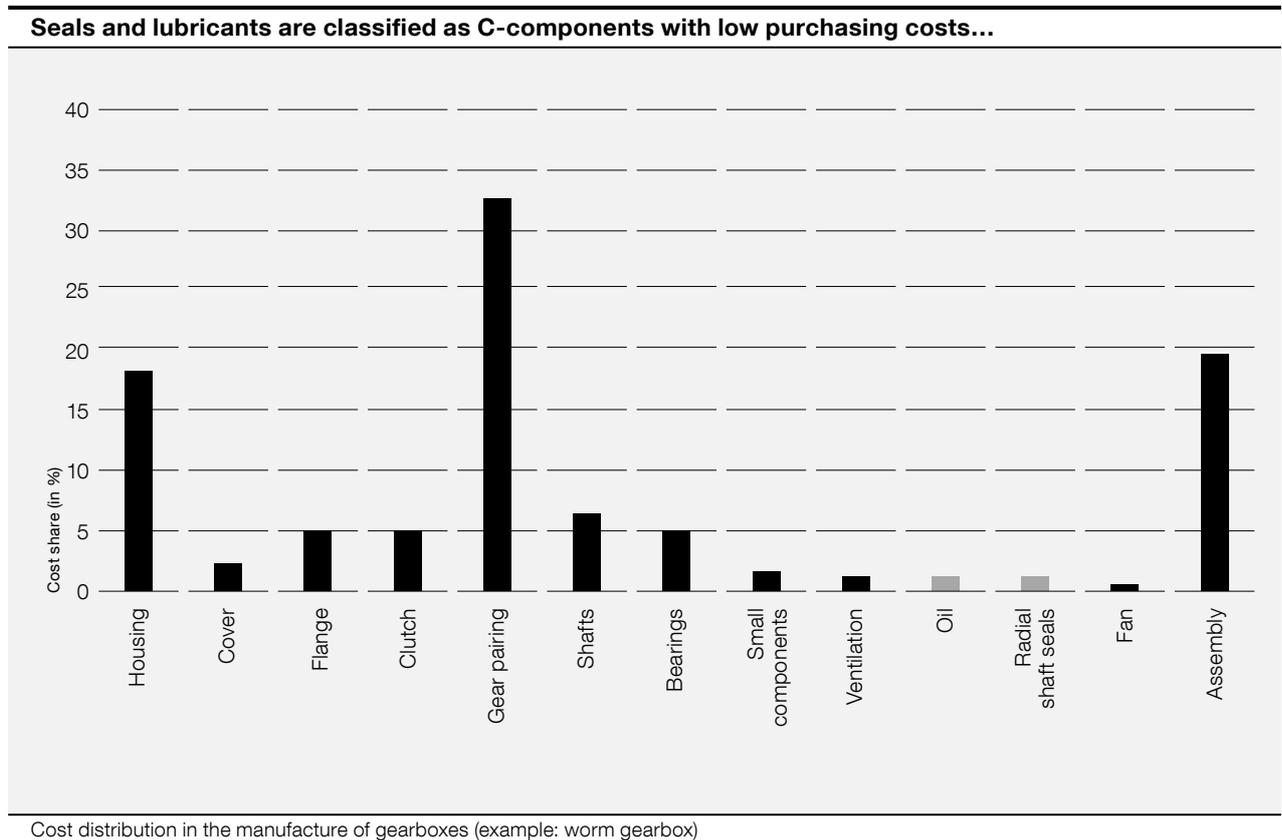
Lube & Seal: Small investment – great result



You will find industrial gearboxes in almost every type of plant and equipment including: conveyors, assembly lines, paper processing machines, extruders, injection molding or filling machinery.

Many of these machines are on continuous duty: 24 hours a day, 365 days a year. Downtime causes not only a lot of aggravation, but costs time, and money and may affect the manufacturer's or operator's reputation. The economic damage caused by choosing the wrong seals and/or lubricants often exceeds their initial purchasing costs many times over.

In the manufacturing of gearboxes, the costs are distributed as follows:





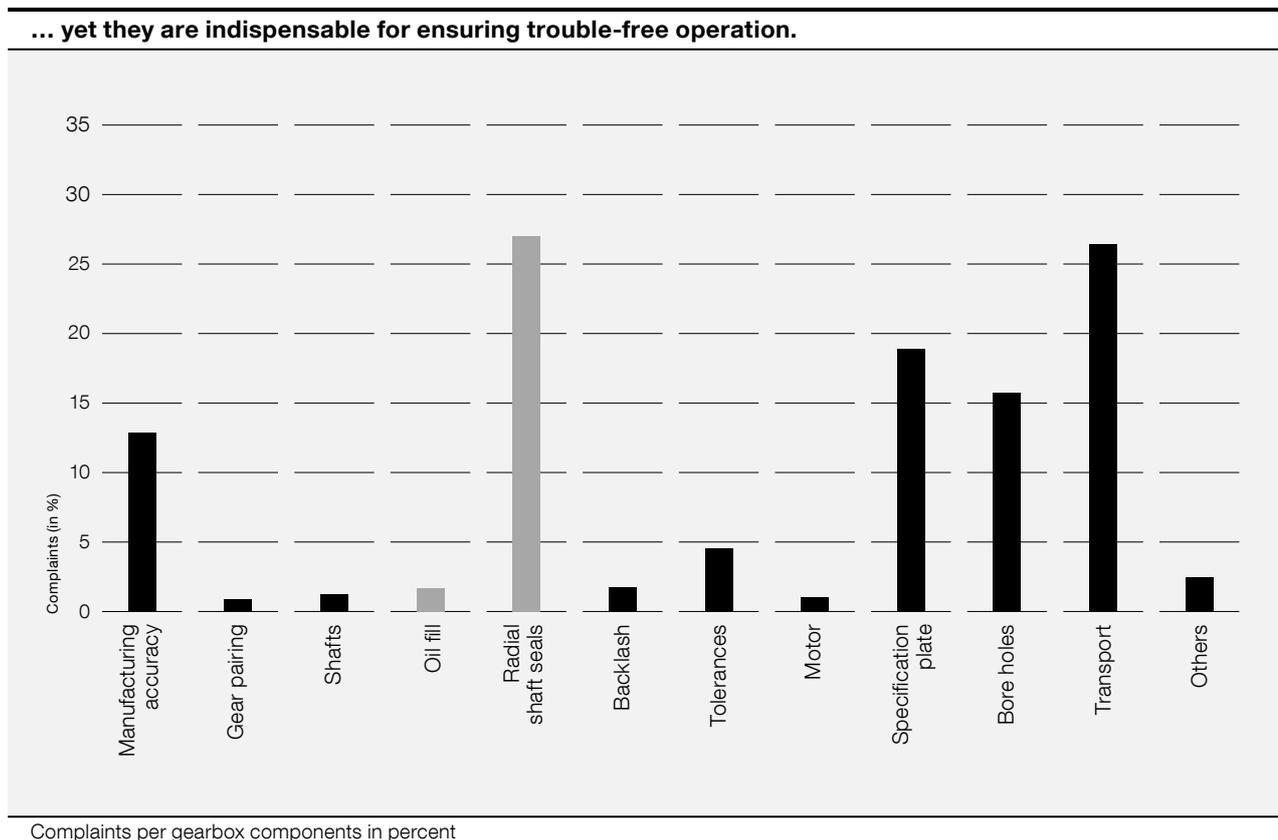
Complaints of leakage of the radial shaft seal can arise when using conventional seals and lubricants. This is due to an increase in power and shaft speeds and the ensuing, often unforeseeable, combined load stress factors.

The demand for

- innovative sintering seals,
- high-performance elastomers and
- synthetic lubricants

... is constantly increasing!

The following overview shows the number of complaints per gearbox component as a percentage:



High requirements in power transmission engineering

Comprehensive understanding of the three tribosystems found in gearboxes

A gearbox is comprised of three tribosystems: The gearing, the bearing and the seal.

Gear lubricants are usually designed to minimize friction and wear within the gearing and bearings. Up until now, seals tended to be neglected in the process of gear lubricant development. Later in operation, however, this omission can lead to severe problems. One of the issues is the possibility of the sealing lip leaking or even worse, gearbox failure.

The trend towards synthetic lubricants further aggravates this problem. Standardized static compatibility tests render only some useful information about a seal's endurance under real-life operating conditions. Oil leakage, excessive tooth flank and bearing wear often entail downtime and/or complaints.

Reliability of your products and potentially your image can suffer. This is true in particular if the seal's lifetime cannot be determined by appropriate calculations or tests and, hence, there is no safeguard for the warranty.

In many applications today, operators bear a high and incalculable business risk. At the same time, the requirements made on gearbox lifetime are constantly increasing.

Lube & Seal integrates the sealing lip tribosystem into lubricant development. The advantage is obvious: seal lifetime can be increased considerably.



With Lube & Seal, the sealing lip tribosystem is now integrated into the lubricant development process.

Lube & Seal: The solution from Klüber Lubrication and Freudenberg Sealing Technologies

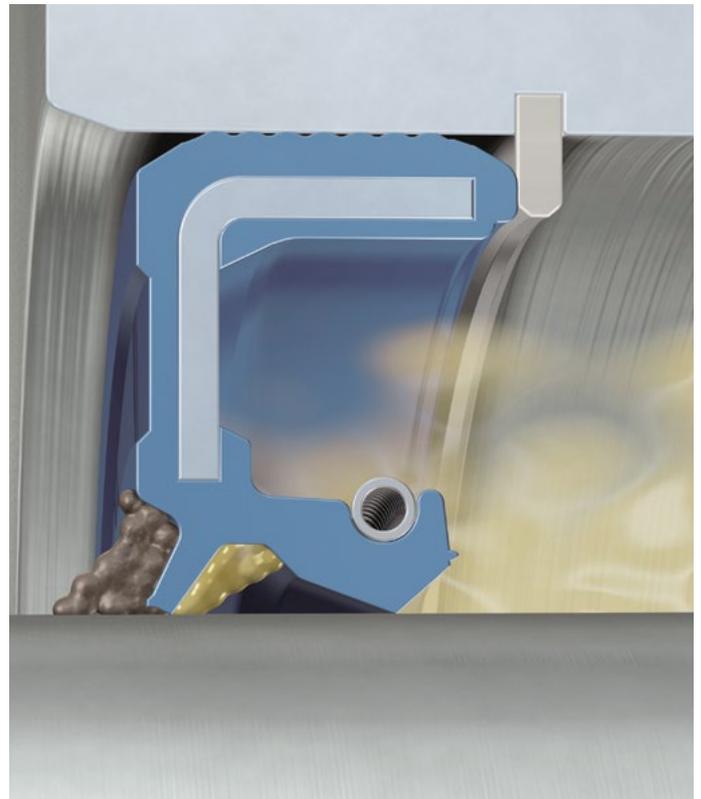
The solution for industrial gearboxes

The seal specialist Freudenberg Sealing Technologies and the lubricant expert Klüber Lubrication have combined their specific know-hows to create a truly comprehensive technological master in this field. Lube&Seal can now offer the power transmission industry a unique and extensive service to optimize sealing systems.

For it is only through a comprehensive approach, considering elastomers, sealing types and lubricants, that durable and reliable sealing systems can be developed.

Lube & Seal helps to

- reduce downtime caused by leakage
- avoid recurring complaints due to leakage
- reduce wear of gearing and bearings
- reduce seal damage caused by abrasion, wear, chemical reactions or running-in of shafts
- improve the technical design of seals
- safeguard warranties
- handle complaints and development projects through the joint support of lubricant and seal manufacturer
- improve product quality and image



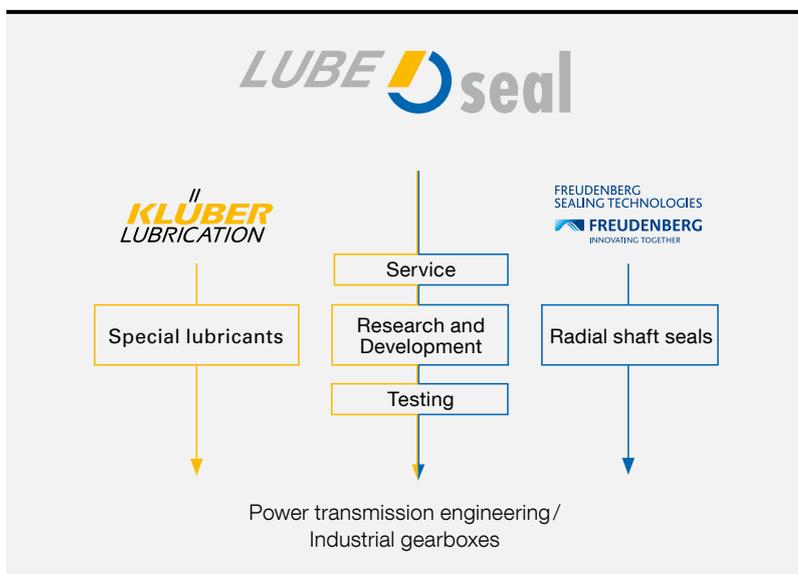
A well-established team: Combined, the seal and the lubricant help to reduce the hazards of leakage

Lube & Seal – and this is how you benefit

Lube & Seal – extends life and reduces leaks

Lube & Seal offers a complete service program with a variety of advantages. This program helps you meet the customer's component lifetime and reliability requirements. For example, we offer an extensive consultation service, expert development and all the necessary performance testing from our in-house test laboratories. This service is also offered on customer-specific equipment.

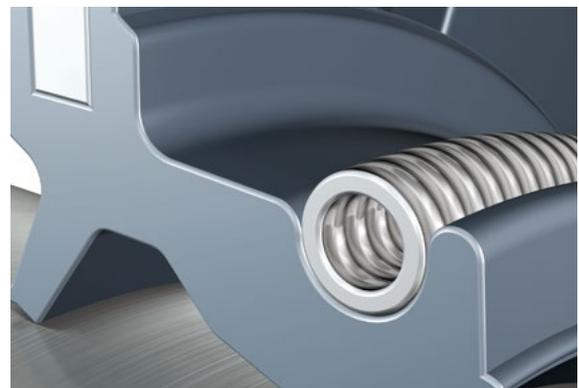
Thus, our customers receive the highest quality solution, tailored to their specific needs and put to the acid test. If leakage problems should ever occur, our experts are available to support and advise the gearbox operator or OEM.



Innovative simmerring seal design and Freudenberg Sealing Technologies materials combined with innovative synthetic lubricants from Klüber Lubrication – all for your and your customers' benefit!

Lube & Seal meets the high demands made in power transmission engineering:

- Lube & Seal – is a service to ensure that customers' technical demands for service life and reliability of gears, bearings and seals are met
- Lube & Seal – is a consultation and performance testing service in test laboratories or on customer-specific equipment
- Lube & Seal – is a first-rate development partnership: We develop new innovative elastomers and lubricants in cooperation with you, our customers
- Lube & Seal – is reliability of products: special lubricants, simmerring seals and materials



Benefit from:

- improved physical and chemical compatibility of simmerring seals and lubricants under practical operating conditions
- extended lifetime and improved sealing effect due to reduced friction and wear
- enhanced reliability due to optimized sealing lip tribosystem
- safeguarding your warranties thanks to well-tested and proven sealing systems

Development

Development for and with our customers

The optimization of the tribological system of the sealing lip is the focus of all our development work on simmerring seals. The complex interactions between the sealing lip, the lubricant and the opposing surface, temperature and pressure require an individual approach in every particular application.

Therefore, Lube&Seal offers a development service for industrial gearboxes. Due to the simultaneous consideration of all the components of the gearbox, the design elements lubricant and simmerring seal can be optimally integrated early in the development of a new generation of gearboxes. Lube&Seal stands for an intelligent relationship management between the lubricant, seal and gearbox manufacturers throughout all the design stages. Lube&Seal paves the way for innovative product development in power transmission engineering and provides active support in achieving new design goals.

Freudenberg Sealing Technologies offers new types and designs of simmerring seals...

- development of suitable seal sizes for reduced installation space
- development of new sealing lip designs, specifically tuned to the hydrodynamic lubrication conditions created with special lubricants
- development of intelligent sealing systems (leak detection)

... and elastomer materials

- low-wear elastomers
- friction-reducing elastomers
- electrically conductive elastomers
- food regulation compliant elastomers
- thermally resistant elastomers

Klüber Lubrication develops new gear oils and lubricating greases for bearings and seals

- lubricants which are physically and chemically compatible with Freudenberg Sealing Technologies elastomers
- lubricants containing special base oils and additives providing an additional wear-reducing effect on Freudenberg Sealing Technologies elastomers
- long-life, energy-efficient gear oils to meet the high performance requirements of modern gears and bearings
- seal and bearing greases compatible with gear oils
- high-performance lubricants for high torque and high temperature
- biodegradable lubricants and lubricant solutions compliant with food regulations

Through the integration of the core competencies of lubricants and sealing under one entrepreneurial roof, we are in the unique position to be able to combine and coordinate the formulations of the elastomer and the lubricant without compromising know-how. Lube&Seal is unique and provides the added value of prolonged service life of the sealing lip tribosystem.



Testing

Lube & Seal – tested and proven

Worldwide, Klüber Lubrication and Freudenberg Sealing Technologies have available more than 1000 test rigs, analysis and test methods to enhance functional reliability of seals and extend the product life cycle of both simmerring seal and lubricant.

The objective of the proverbial “acid test” is to obtain valid conclusions on life times. One of the main advantages is that you can safeguard warranties on the basis of sound findings. Thus, Lube&Seal contributes to enhancing product quality and improving risk management.

Tribological solutions offering specific benefits for particular customer demands require a variety of testing possibilities. We develop new test rigs and methods to enable us to provide well-founded predictions regarding service life. Tests on customer-specific equipment provide valuable information to your customers.

Some examples of the extensive test procedures from the areas of lubrication engineering, seal technology and chemical analysis:

- compatibility tests
- chemical analysis of lubricants
- FZG tests
- worm gear tests
- bearing tests (FE8, FE9, ROF)
- dynamic simmerring seal tests with or without pressure
- customer-specific dynamic test run (temperature, time, speed)
- determination of sealing lip temperature
- coefficient of friction at the sealing lip
- dust test
- low temperature test
- corrosion protection test
- wash-out tests

Test results

Lube & Seal certified

The tests have four objectives:

- illustrate the service life of the Lube & Seal solution as compared to the standard “state of the art”
- determine friction and wear
- prolong service life in a reliable and reproducible manner
- minimize failure rates during service life

Influence of the medium being sealed on the lifetime of the simmerring seal

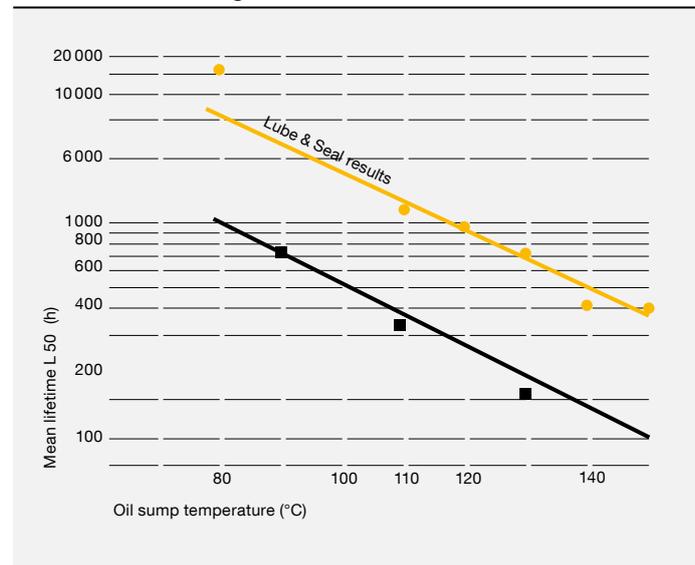
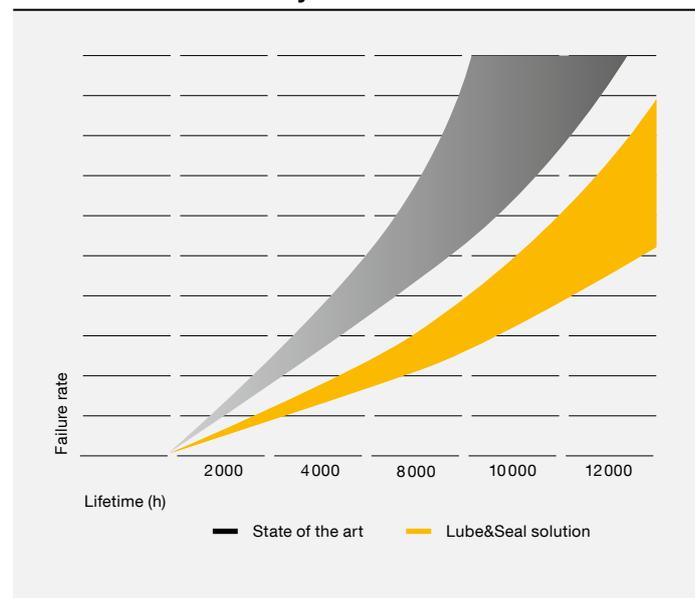


Illustration of reliability





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Klüber products are continually improved. Therefore, Klüber Lubrication reserves the right to change all the technical data in this brochure at any time without notice.

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Klüber Lubrication – your global specialist

Innovative tribological solutions are our passion. Through personal contact and consultation, we help our customers to be successful worldwide, in all industries and markets. With our ambitious technical concepts and experienced, competent staff we have been fulfilling increasingly demanding requirements by manufacturing efficient high-performance lubricants for more than 85 years.