

Whitepaper

The power of speciality lubricants in automation.

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A brief summary.

Production companies in all industries today are under huge time and cost pressures: processes need to be efficiently designed and machines must run around the clock. It's the only way to meet the daily quota. Without the automation of production processes, however, this would be unthinkable. Whether it's automated conveyor systems or intelligent robotics, the age of Industry 4.0 sees many machines running almost completely autonomously and processes being constantly optimised, with everything perfectly intertwined. Well, in theory, at least.

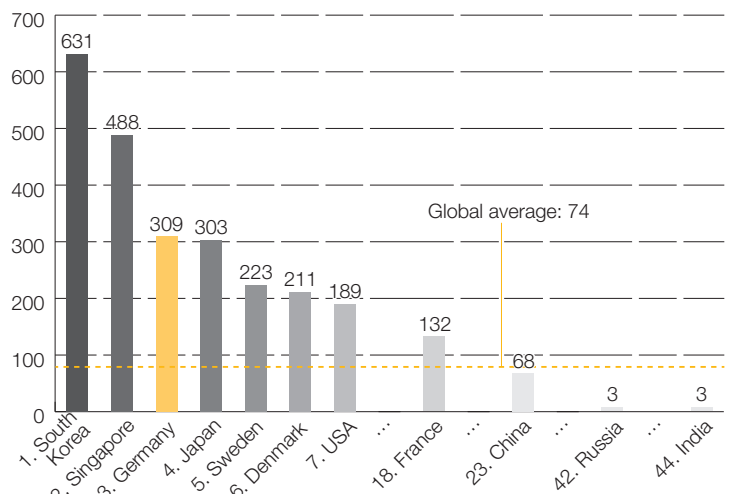
But where there's movement, there's friction, and extreme ambient conditions prevail in many sectors. In combination with a constant need to go faster, wear, corrosion and frequent unexpected breakdowns are not uncommon. In automated industrial plants this can be particularly problematic, causing frequent downtimes for the whole production or, in the case of made-to-order or just-in-time production, bringing the whole company to a standstill.

The solution? Specialty lubricants. These lubricants are powerful and are perfectly tuned to their respective use, significantly reducing wear and corrosion and the resulting danger of unexpected breakdowns. Extending maintenance intervals also cuts costs and enhances plant availability.


The rapid evolution of automation.

According to World Robotics Report, in 2017, there was an average of 74 robots for every 10,000 employees in the manufacturing industry. Europe came ahead of America and Asia with 99 robots per 10,000 employees. And the numbers keep on rising. In Asia, for example, the rate of growth for robot density between 2012 and 2018 came in at 16 per cent.

Industrial robots per 10,000 employees per country in 2017:



Source: IFR International Federation of Robotics/World Robotics 2017



In some modern industrial facilities, there can be up to several hundred lubrication points, all with different requirements. For production managers and equipment manufacturers, keeping an overview of these points is no mean feat. As a result, they can run the risk of missing lubrication intervals or using unsuitable lubricants, which, sooner or later, leads to machine failure.

High-performance specialty lubricants are becoming more and more important.

Consequently, there is now an ever-increasing demand for specialty lubricants and the related know-how. Experience with lubricants in various industries and areas of application is crucial for finding the perfect solution in every case.

Naturally, chain drives in paint furnaces with extreme temperatures need different lubricants than, for example, heavily loaded bearings and slideways. With a focus on food safety, requirements for the food industry differ too, as lubricants must comply with the relevant standards.

Here, in addition to the relevant expertise in highly complex lubrication processes, close collaboration between equipment manufacturers, production managers and lubricant manufacturers is essential. Only then can tribology experts select and develop the perfect lubricant to meet the customer's needs and wishes. Experts can also share their know-how to ensure that the machines continue to be treated correctly and lubrication charts are observed.

An overview of all lubrication points with Total Productive Management (TPM).

In the age of Industry 4.0, digital solutions help to improve processes and reduce personnel and downtime costs. For the lubrication processes in production, Klüber Lubrication offers a complete digital maintenance management system to give customers a constant overview of all lubrication points. The EfficiencyManager is the central platform where all data and functions are brought together. It covers all aspects of a professional Total Productive Management system:

- ▶ **Maintenance Management:** In the EfficiencyManager, all facilities, machines and maintenance-related components are clearly displayed to allow users to control lubrication and maintenance tasks. A database for maintenance staff, operation managers and operators enables for high efficiency and standardised processes. Another benefit is the efficient transfer of knowledge among operating staff. The integrated audit support also ensures optimal compliance documentation.
- ▶ **Performance Analysis:** Based on on-site inspections and lubricant analyses, the customer receives a transparent overview of the status of their machines and lubricants. It can also be used to visualise trends and use these to develop corresponding maintenance measures together with experts from Klüber Lubrication.
- ▶ **Machine Monitoring:** Inline sensors assess the condition of gears, chains and oils. An overview can even be provided for decentralised facilities – with data, notifications and recommended action in real time. Predictive maintenance allows users to predict and plan maintenance instead of using fixed intervals. This full transparency also saves users unnecessary travel, time and costs.

The best maintenance is the maintenance you don't need.

It's not just unexpected machine breakdowns that reduce productivity. Any maintenance measures also mean a standstill for production. The aim, then, is to have as much time as possible between maintenance intervals without risking increased wear or any component malfunctions.

One way of achieving this is by using high-quality, specially-developed specialty lubricants. But there's more to lubrication than that when it comes to optimising the maintenance process. For example, automated application of lubricants to areas that can only take a limited quantity of lubricant. Or lubricants with a cleaning effect: these can remove residues on the chain in high-temperature chain applications.

Another option for extending maintenance intervals is designing maintenance based on a needs-oriented system. Instead of predefined lubrication intervals, a needs-based system reviews the current lubricant condition and only relubricates when necessary. This is particularly useful if the lubrication point is difficult to reach.

For this purpose, Klüber Lubrication offers used lubricant analysis. An oil sample is taken from the machine and analysed in the lab for things such as ageing, viscosity, level of impurity, water content and many more. This helps to make a clear recommendation as to whether the lubricant can continue to be used without any problems or not.

An even more convenient service is sensor-based oil condition monitoring.

This uses the EfficiencyManager software tool to monitor the condition of the lubricant in real-time and allow the user to plan maintenance and repair measures in advance, reducing downtime as well as lubricant costs.

All-round service throughout the entire product life cycle.

The lubrication of automated industrial plants is a continuous process and it doesn't end with the commissioning of the plant. For this reason, it is essential to make sure employees have expert knowledge when it comes to lubricants. That way, they are able to better understand the lubrication process and establish a professional lubricant management system, meaning they are always in the position to introduce the right measures at the right time. The lubricant manufacturer can help to impart this know-how with in-person training and lubrication charts or by digitalising maintenance measures.



Lube&Seal: when lubricant and seal work perfectly together.

A common problem in automation is lubricant leakage from machine and conveyor system gearboxes. Even small leakages can lead to the gearbox needing to be replaced, bringing the whole production to a standstill as a result. Up to 40 per cent of lubricant leakage in power transmissions are caused by radial shaft seal breakdowns. These malfunctions are often due to the wrong lubricant–seal combination.

The interaction between the seal's elastomer and the lubricant is complex, and it can have a significant impact on the performance and service life of the system. At the root of the problem is the fact that seal and lubricant suppliers usually work independently from one another, meaning it's extremely difficult to find the perfect coordination between seal and lubricant. Thanks to unique, worldwide collaboration across industrial sectors, Klüber Lubrication has the solution. Working with seal specialists from the Freudenberg Group, KL has brought together the knowledge from both worlds into one joint project:

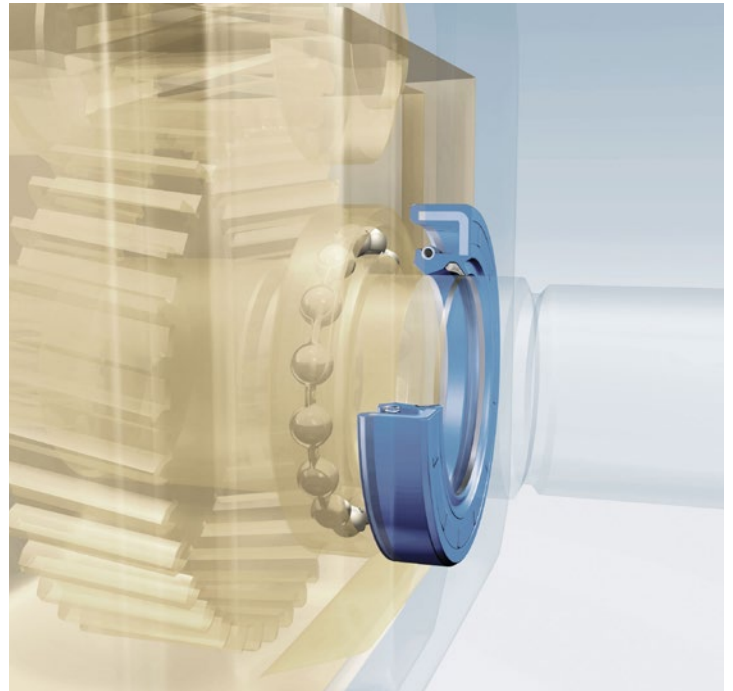
Lube&Seal. The aim of the project is to gain a comprehensive understanding of the interaction between seal and lubricant in the respective application and use this knowledge to develop the perfect lubricant–seal combination.

The three most important interactions between seal and lubricant.

The physical interaction is seen in the diffusion of material components and additives. This can lead to swelling or shrinkage of the elastomer, which can cause leakage or increase wear.

If diffusion takes place predominantly in one direction, either from the elastomer to the lubricant or vice versa, this can lead to leakage or increased wear, respectively. Another factor is the lubricant's wetting behaviour, i.e. how well the lubricant is spread across the surface of the elastomer and thus how well it reaches the contact zone between the radial shaft seal and the shaft. A thin lubricating film is needed here to reduce friction and dissipate heat. If wetting is insufficient, this can lead to wear on the radial shaft seal and the shaft itself as a result of lubricant starvation.

Finally, we have the chemical interaction, which can also impact the elastomer's mechanical properties. For example, the crosslinking density of the polymer chains in the seal may change. An increasing crosslinking leads to higher hardness, which in turn runs the risk of fissures. Reducing the crosslinking makes the seal softer and leads



to loss of tension towards the shaft. The subsequent large seal gap caused by this loss of tension can then lead to leakage.

By perfectly coordinating the elastomer material and lubricant composition, we can control this interaction.

Testing for enhanced understanding.

Identifying all of these interactions on a case-by-case basis requires expertise and extensive testing. Conventional static tests for the compatibility between seal and lubricant tell us very little about the seal's resistance under normal operating conditions. These tests also don't take into account the mechanical deformation of the seal elastomer on the shaft surface.

That's why the Lube&Seal team has developed dynamic testing and analysis techniques that show the changes to mechanical properties over time. The results can then be used to help perfectly coordinate the seal and lubricant with one another. The dynamic test conditions can also be adapted on a case-by-case basis to simulate industrial applications, e.g. industrial robot precision gearboxes.

Case studies show that it's worth the effort. The perfect combination of seal and lubricant reduces machine downtime, which translates into significant operating cost savings for the company

Find out more about lubricant solutions for automated industrial plants here: <https://www.klueber.com/lube-and-seal>

At a glance – the benefits of high-quality lubricant solutions:

- ▶ **Reduced downtime** and high plant availability thanks to optimal lubricating effect and thermal/ageing resistance.
- ▶ **Cutting costs** for maintenance and repairs thanks to longer maintenance intervals.
- ▶ **Longer life** as every lubricant is perfectly tuned to the respective field of application to reduce corrosion and wear.
- ▶ **Reduced energy consumption** thanks to increased performance and less friction.
- ▶ **Highest quality assurance:** All specialty lubricants are produced in certified factories, thoroughly tested and have repeatedly proven effective in practice.
- ▶ **Extensive all-round service:** from employee training and lubrication plans to lubrication point analysis.
- ▶ **More efficient processes:** upon request, we can work together with you to devise measures for a better maintenance process.



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