



Whitepaper

Enhancing the mobility of the future

Speciality lubricants for electric vehicles

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A brief summary

The conversion of automotive drive systems and powertrains to electric power has increased its pace. As electric motors and electric vehicles are becoming more widespread, the automotive industry is seeing hitherto unknown technological changes. Manufacturers are not only facing the challenge of driving forward technical solutions for their products, but also of finding suppliers who are capable of proactively supporting innovations or developing

their own. Lubricants are one important area where this applies. Lubricants were optimised for vehicles with internal combustion engines over decades of joint development efforts, and now they have to master the new challenges of electric mobility. The development of corresponding new lubrication solutions is in full swing. These efforts have brought about first results that design engineers can work with.

New ways for manufacturers: power trains going electric

Electric powertrains have a fairly simple design and do not require all the design expertise grown at classic car manufacturers over decades. What is emerging is a new competitive landscape with new actors from various industrial sectors and countries posing a challenge to the classic automotive industry. At the same time, technological diversification is taking place: differing drive configurations ranging from conventional battery-powered vehicles and hybrid cars to hydrogen and plug-in hybrid vehicles each require their own powertrain design. But not all those drive

technologies are suited to be used in all automotive segments. Most manufacturers prefer to use the well-known components of an electric powertrain, involving a relatively small gearbox, in most cases for reduction only. Especially in applications with a high power density, they require efficient lubrication and improved cooling. This means that new challenges have to be met by the lubricants to be used.

Downsizing: more heat requires cooling

Due to smaller and simpler gearboxes, more compact powertrain designs will be feasible. This downsizing, however, will bring about new challenges, for example more heat being generated, and higher rpm. For design engineers, this entails the need for efficient, simple solutions, for example in the form of a lubricant that is better at providing the required cooling effect.

E-mobility changes requirements to be met by lubricants

Product	Combustion engine	Electric drive
1 Engine oil	✓	X
2 Hydro Lubricants	X	✓
3 Lubricants with ionic fluids added	X	✓
4 Gear oil	✓	✓

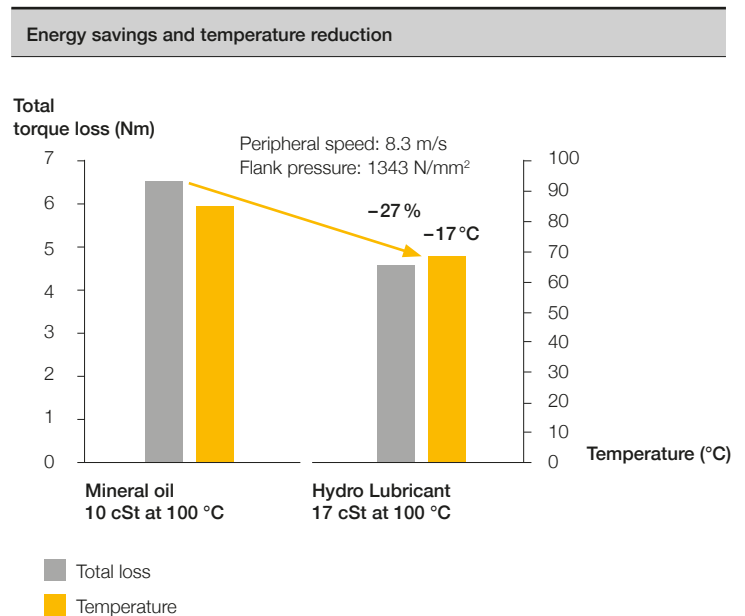
- x No longer needed
- ✓ Offer benefits to solving design problems

A highly efficient response to this requirement can be found in synthetic high-performance gear oils based on PAO or polyglycol. Tried-and-tested synthetic high-performance gear oils are also available in low viscosities for the use in electric vehicles. The low friction attained with these synthetic high-performance gear oils can already today reduce gear temperature by up to 5 °C compared with conventional lubricants.

Hydro Lubricants containing water as a base oil show extraordinarily low friction and an improved cooling effect. The lubricant can help to extend the travel range of electric vehicles and reduce gearbox temperature by up to 17 °C compared with conventional lubricants. With the lower temperature, engineers have more options for their vehicle design. The cooling effect has been confirmed by various tests in the lab and at customers. Combined with the low friction, the excellent cooling effect makes Hydro Lubricants an extremely valuable technology for gearboxes in electric vehicles.

Innovative lubricants call for innovative seals

Another aspect deciding the future success of electric mobility is the right sealing technology for a fully integrated electric powertrain. Lubricants and seals always interact very closely. Both are part of a tribological system, and their mutual compatibility is indispensable for both to function as they should. The companies Klüber Lubrication and Freudenberg Sealing Technologies (FST), each an expert in its own field, cooperate closely to make lubricants and seals work in harmony.

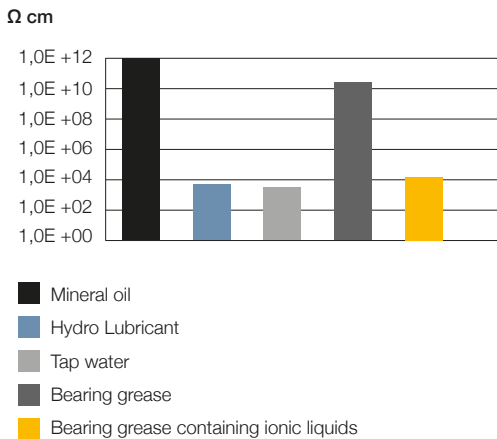


In order to get pioneering new concepts for integrated electric powertrains under way, both companies are jointly developing dynamic seal designs that work with Hydro Lubricants and meet the rising requirements of the electric vehicle market. This allows the excellent cooling effect and higher efficiency of Hydro Lubricants to be combined with the low-friction sealing solutions from FST to enable innovative powertrain design.

At the core of electric driving: electroconductive lubricants

Electroerosion in rolling bearings of electric motors is a phenomenon which has been known for a long time. The increasing use of frequency converters in modern power transmission systems for continuous speed control of motors and generators has led to more damage being caused by electric erosion. Also the current trends towards using higher voltages, e.g. in automotive vehicle power systems, will result in higher energy discharges in the future.

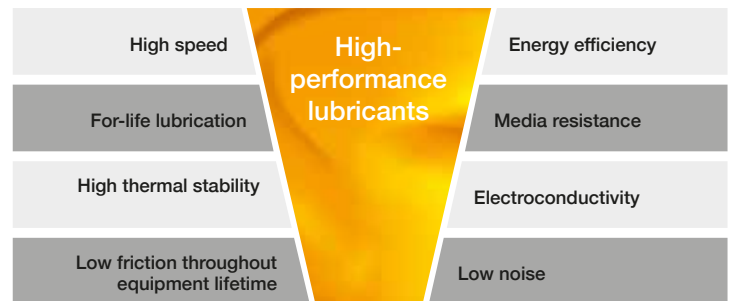
Specific electric resistance



An innovative lubricant concept that can be used here is based on ionic liquids. This modern, patented concept turns the lubricant into a „lightning conductor“ to prevent harmful potentials from forming. In addition to the vehicle-relevant data like rpm, smooth operation and extended service life, this new generation of speciality lubricants also addresses the issue of electric conductivity. Furthermore, running times up to twice of those attained by greases without ionic liquids were confirmed on rolling bearing test rigs.

High-performance lubricants – the response to many challenges

The technical challenges in electric cars are immense, especially because of the high speeds with speed factors exceeding 1 million mm/min going along with high temperatures >100 °C throughout the electric motor’s runtime. It takes high-performance lubricants to master these challenges.



Infrastructure for battery charging receives more attention

When looking at the requirements of electric cars, one aspect is frequently overlooked: the infrastructure for battery charging. As the number of vehicles with hybrid or electric drive is growing, so will the number of charging points over the next few years. Besides plug-in contacts inside the charging columns, other friction points inside the charging plug and the plug-in contacts in the car are exposed to specific influencing factors.

Contacts made of copper alloys and coated with gold, silver or tin are subject to particularly high stresses especially during rapid charging or after an elongated period of use. Frequent plug cycles, a wide temperature range and high insertion forces require special surface protection. It is essential to prevent friction corrosion, wear and rising resistance over the contact's service life. The ability to apply the right lubricant to the contact point with utmost precision is another important aspect for manufacturers. Klüber Lubrication offers a wide range of tribological solutions for electrical contacts and can draw on many years of experience with applications of that type. New products are developed for specific customer requirements.



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German Innovation Award

In 2018, Klüber Lubrication received the German Innovation Award for its innovative Hydro Lubricants technology; the award is presented annually by the German Design Council.

The race for electric mobility has only started. Don't miss out on it!

Klüber Lubrication is currently cooperating with various partners from science and industry to continue the development of innovative Hydro Lubricants and bring new solutions to the market that would make electric mobility more efficient. Join us in our efforts to shape the future of electric mobility and speciality lubricants.

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