



Whitepaper

Hydro Lubrication

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Using water as a functional component in speciality lubricants creates opportunities for a whole new range of applications. As a result, industrial operators in various industries are offered with performance and sustainability benefits along the entire process chain.

Executive Summary

Thinking about the basic substance of speciality lubricants, we almost automatically associate them with oil – primarily mineral oil. This fact is correct: As of 2017, the majority of all industrial lubricants are mineral oil-based. However, despite their widespread use, conventional lubricants reach their functional limits in various scenarios. In addition to the finiteness of natural resources, their safe and environmentally sound handling, use and disposal often requires considerable effort in regards to occupational safety.

At the same time industrial operators' expectations towards innovative special lubricants are increasing. They range from occupational and food safety to biodegradability, longer life cycles and reduced emissions and energy consumption.

Companies and research institutes working in the field of tribology – the science of friction, wear and lubrication – are therefore continuously searching for new components that offer new functions for lubricants. One approach, which originates from the tribology specialist Klüber Lubrication, is to make use of a raw material which previously seemed extremely limited from a tribological point of view. Klüber Lubrication is using the element water either as base oil or as an additive for a whole new group of lubricants, called Hydro Lubricants. The benefits of Hydro Lubricants are numerous and diverse. They range from extremely low friction coefficients to improved occupational safety and sustainability throughout the whole life cycle. By 2025, Klüber Lubrication aims to develop and launch a portfolio of Hydro Lubricants in cooperation with customers from various industries. In the long-run, the new lubricant class can decisively shape the future of tribology.

Increasing demands on industry and tribology



In manufacturing industries, sustainability is increasingly important to differentiate from competition and to communicate leadership in innovation. Compulsory values, legal requirements and voluntary limits aimed at reducing resources, emissions and energy consumption imply an increasing demand for new and diverse solutions. Industrial speciality lubricants are supporting to achieve these sustainability goals – as defined, for example, in the UN Global Compact or the ISO 50001 standard.

However, speciality lubricants are not only required to further reduce friction, wear and emissions – for instance in food production, the automotive industry or mining. Regulations with regard to occupational health and safety are also becoming ever more stringent. There is a growing demand for speciality lubricants that can be used worldwide and that satisfy the diverse legal requirements of different countries and regions.

Water as a basis: obvious and yet visionary

While searching for a substance that can keep up with all general and industry-specific challenges, water is the obvious choice of basic raw material: globally available, non-toxic, non-flammable. The benefits are clear – but, so are the tribological boundaries. These include not only low viscosity, but also evaporation and freezing points, oxidation, corrosion and microbiological growth.

After intensive research, Klüber Lubrication has succeeded in pushing these limits. With water as a functional component, there are crucial differences in the way the lubricant behaves. Among other things, this can contribute to a much lower operating temperature, significantly reduce friction coefficients or allow greater tolerance for water intrusion.

In 2018, the company expects to release a gear lubricant, in which water acts as base oil. Benefits for users include excellent cooling capacity and tolerance for water intrusion for example in the marine industry. Even a low percentage of water intrusion can significantly reduce the performance of a conventional lubricant. This of course does not apply to Hydro Lubricants, that by nature already contain a certain water content.

Klüberplus C 2 series: the first Hydro Lubricants are already on the market

The first product group to use this technology transfer is already on the market known as the Klüberplus C 2 series. In this lubricant designed for conveyor belts, water and oil constituents form a homogeneous solution. This allows much finer, more even application and significantly reduces the quantity of lubricant required. This considerably reduces the amount of cleaning that the operator needs to perform.

The next stage of friction reduction



The positive effects of water

Water is often used as a coolant because it has high thermal conductivity compared to other liquids. Because of this property, lubricants with water as a functional component can reduce operating temperatures by up to 25 °C compared to oil-based lubricants. This ability has been proved on various components in laboratory and field tests.

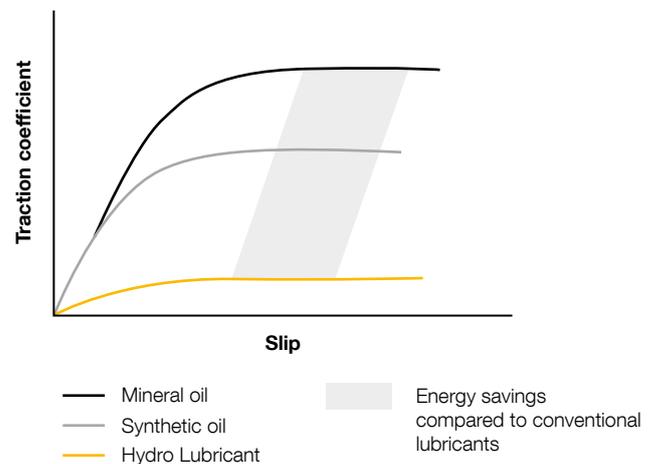
Moreover, water contributes to energy savings. On the one hand, reduced operating temperatures in the component means more energy efficiency per se. Considering the viscosity of the lubricant for a particular application at operating temperature, this cooling effect means that it may be possible to select a Hydro Lubricants of a lower ISO viscosity grade. This offers clear energy saving potential. This is supported by the fact that Hydro Lubricants typically have a very good viscosity index.

On the other hand, the lower inner friction of Hydro Lubricants also supports to save energy.

„Superlubricity“ comes into reach

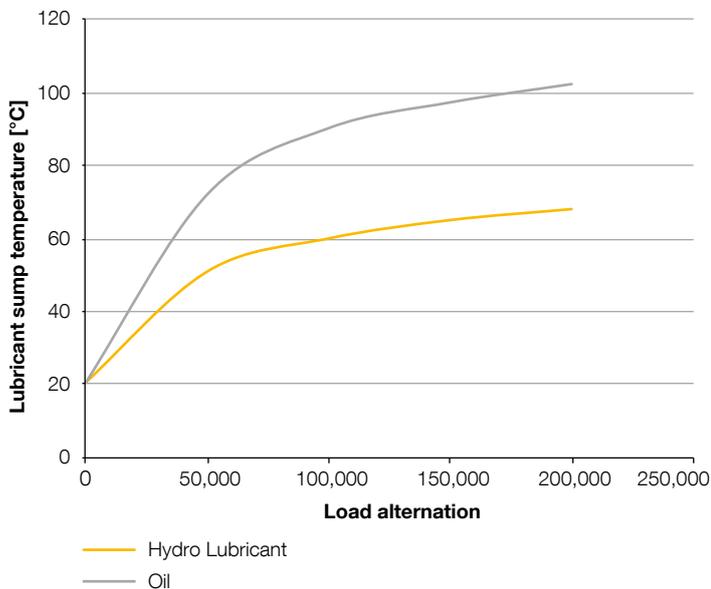
Hydro Lubricants have unprecedented potential when it comes to friction. Friction can be reduced to such an extent that superlubricity is within reach in which the friction and traction coefficient can drop to below 0.01. Research is underway to further analyse these low friction coefficients in various applications.

Friction reduction of Hydro Lubricants



In this scenario, the traction coefficient corresponds to around one tenth of the value that can be achieved with the best available oil-based lubricants, which results in a whole range of positive effects. These range from energy savings and reduced emissions to longer life cycles of different components.

Cooling effect of a Hydro Lubricant compared to standard oil with the same viscosity



Searching for development partners

With the wide range of benefits and possible applications, we just begun to harness the potential of Hydro Lubrication. Following the Klüberplus C 2 series for conveyor belts, Hydro Lubricants for gears, bearings and industrial chains are in development – all currently being tested.

The more specifically we develop a Hydro Lubricant for a particular application, the more extensive are its benefits. The Klüber Lubrication

development department is therefore looking for more industrial cooperation partners to further develop Hydro Lubricants.

Next to e-machines and e-mobility, industries like food, marine, mining and forestry are of high relevance. For companies with a strong focus on innovation and sustainability many opportunities can arise in terms of creating a competitive advantage and taking on a leading role in terms of innovation.

The benefits at a glance

With Hydro Lubricants, Klüber Lubrication is helping to improve customers' sustainability

Occupational Health and Safety

- No harmful solvents
- No slippery floors
- Easy and safe handling
- Improved fire protection
- Fewer harmful vapours
- Improved plant hygiene

Environmentally friendly

- Reduced emission of Volatile Organic Compounds (VOCs)
- Reduced water pollution
- Reduced water consumption
- Reduced CO₂ emissions

Operational Excellence

- Reduced friction
- Longer service life of components
- Similar wear protection and Extreme Pressure properties to conventional lubricants
- Easier cleaning
- Reduced problems with water contamination

Energy saving

- Lower operating temperature with outstanding thermal conductivity
- Reduced friction
- Support with meeting the requirements of ISO 50001