Powerful, naturally.
Environmentally acceptable and biodegradable lubricants for the marine industry
Attain both environmental and economic advantages – Powerful, naturally!

Reducing impacts from shipping operations on the environment is important to the shipping industry. As a shipping operator, you are aware of the expanding body of environmental regulations affecting your business. Additionally, a growing interest in ecological issues is driving your customers to ask you for environmentally sound operating practices.

At the same time, you also need to have a lock on your costs. You invest in ships for the transportation of goods and people or for offshore services and you seek a profitable return on your investments.

The lubricant – a small investment that can make a big difference

Selecting the right lubricant is critical to maximising the output of your marine equipment while minimising operational costs. In today’s environment, a lubricant that combines ecological and economic advantages is vital to the success of your operation. Klüber Lubrication environmentally acceptable lubricants are the perfect choice. We work closely with manufacturers of marine components to extend service intervals, lengthen component lifetime and increase operational reliability while meeting regulatory and market demands for environmentally sustainable practices. With specialty lubricants from Klüber, you save on total operating costs while you help save the environment.

Ecological challenges

Reducing the stream of mineral oil-based lubricants entering oceans, bays, harbours and inland waters from standard operational practices is a major challenge for marine operators. According to the US Environmental Protection Agency, several million litres of lubricants are discharged into commercial harbours each year through stern tube leakages alone. Additionally, millions of litres more are estimated to be discharged through other on-deck and thru hull machine elements such as cranes, winches, stabilisers, and bow thrusters. Oils and greases are needed to operate your vessel and yet the next wave can sweep them away into the sea.

Legislation, Regulation and Compliance

The use of environmentally acceptable lubricants (EALs) receives more and more attention from legislators and regulators around the globe. In the USA, the use of EALs has become mandatory as defined in the US Environmental Protection Agency’s Vessel General Permit. Lubricants used for mechanical equipment subject to immersion and in oil to water interfaces (stern tubes, thruster shafts, fin stabilisers) must be biodegradable, non-toxic, and non-bioaccumulating as long as an approved EAL is available.

To be “Environmentally Acceptable”, a lubricant has to be:
- Non-bioaccumulative: the chemicals may not accumulate in the tissue of an organism and enter the food chain. Test Methods: OECD 117 and 107.
- Biodegradable: the constituent substances of a lubricant must break down naturally according to the required test standards. In general, at least 60 % of the formulation has to biodegrade within 28 days under the test conditions. Acceptable test methods include: OECD Test Guidelines 301 A-F, 306, and 310, and International Organization for Standardization 14593:1999.
- Non-toxic: the formulation must pass either OECD 201, 202, and 203 for acute toxicity testing, or OECD 210 and 211 for chronic toxicity testing.

Performance remains the key to lubricant selection

High performance synthetic lubricants, including the synthetic ester oils from which Klüber Lubrication’s biodegradable lubricants are designed, reduce friction and reduce operating temperatures thereby reducing energy consumption. As an example, in land based systems, a 1 % to 2 % reduction in energy usage has been documented by switching to a better lubricant in gear box systems. Klüber believes the same efficiencies gained in on-land applications can be achieved onboard vessels. Even a 1 % energy reduction would directly relate to fuel cost savings. Switching to high-efficiency gear lubricants could be a component of a Ship Energy Efficiency Management Plan.
Just the best for you: tested quality

Klüber does not launch a new lubricant unless it has been put through extensive testing. To achieve this, we have developed a test bay that is un-paralleled in the industry. We simulate the exact loads lubricants are subject to in your applications: fluctuating temperatures, high surface pressure, micro movements, and/or salt air and salt water.

Klüberbio LG 39-700, Klüber Lubrication's new open gear grease, provides the combination of biodegradability and performance. The finished lubricant is formulated with more than 90 % renewable materials. The base oil of the grease was developed with new technology that yields a higher viscosity and considerably improved low-temperature behaviour compared to other ester type oils. Furthermore, Klüberbio LG 39-700 outperforms the wear protection of other lubricants for this application. By extending the service life of pinions, large gears and tooth racks, this product contributes to energy savings and operational cost savings over the entire lifespan of the ship.

We work together in close collaboration with leading OEMs to design lubricants that maximise the performance of their products. You can achieve best operational practices through selecting Klüber lubricants.

If you have any questions regarding our products or if you wish to discuss a particular application, please contact us. Our specialists are nearby and happy to help.

An example: Klüberbio LG 39-700

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Modified FZG slow speed wear test acc. to DGMK 377-01

Klüberbio LG 39-700 shows lower wear rates than other open gear lubricants.

\[ v_t = 0.05 \text{ m/s} \quad v_t = 0.57 \text{ m/s} \]

\[ \Sigma \text{wear} \]

\[ \text{Duration [h]} \]

Klüberbio LG 39-700

Klüber GRAFLOSCON C-SG 0 ULTRA

Competitor product NLGI 1, biodegradable

Competitor product NLGI 2, biodegradable

\( v_t \) Gear rim peripheral speed
Speciality lubricants on board

This illustration shows the various applications of our marine lubricants. To show as many applications as possible in one illustration, we included components of the following ship types in this synthetic ship: Ferry, cruise ship, cargo ship, wind turbine installation vessel, anchor handling tug supply vessel.
Jacking system
Tooth rack & pinion: Klüberbio LG 39-700, Klüberbio AG 39-602
Planetary gearbox: Klübersynth GEM 2-320

Anchor handling winch
Open gear: Klüberbio AG 39-602
Enclosed gear: Klübersynth GEM 2-320
Hydraulic motor: Klüberbio LR 9
Steel wire rope: Klüberbio AG 39-602

Offshore crane
Hydraulic system: Klüberbio LR 9
Bearings: Klüberbio BM 32-142
Steel wire rope: Klüberbio AG 39-602

Fairleads
Bearings: Klüberbio BM 32-142

Stern roller
Bearings: Klüberbio LG 39-700

Towing pins
Klüberbio AG 39-602

Rudder
Bearings and seals: Klüberbio AG 39-602

Rail crane
Bearings: Klüberbio BM 32-142
Hydraulic system: Klüberbio LR 9
Steel wire rope: Klüberbio AG 39-602
Rack & pinion: Klüberbio AG 39-602

Propeller stern tube
Klüberbio RM 2

Azipod
Propeller shaft seal: Klüberbio RM 2
Steering shaft seal: Klüberbio AG 39-602

Thruster / rudder propeller
Steering shaft seal: Klüberbio AG 39-602
Gear: Klüberbio EG 2
# Environmentally acceptable and biodegradable lubricants for the marine industry

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<td>Gear oil</td>
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<td>ISO VG 68 / 100 / 150 Meet CLP requirements according to ISO 51517-3 Biodegradability &gt; 60 % European Ecolabel</td>
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<td>Klüberbio EG 2-100 1)</td>
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<td>Klüberbio EG 2-150 1)</td>
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<td>Gear oil</td>
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<td>Hydraulic oil</td>
<td>Klüberbio LR 9-32 1)</td>
<td>ISO VG 32 / 46 / 68 Meet HEES requirements according to DIN ISO 15380 Biodegradability &gt; 60 % European Ecolabel Swedish Standard SS 15 54 34</td>
<td>Anchor handling / mooring winch</td>
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<td></td>
<td>Klüberbio LR 9-46 1)</td>
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<td>Ship crane Offshore crane Controlable pitch propeller</td>
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<td>Chain oil</td>
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<tr>
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<td>Klüberbio M 72-82</td>
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<td>Deck machinery</td>
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<td>Klüberbio Z 2-5</td>
<td>ISO VG 5 Biodegradability &gt; 60 %</td>
<td>Miscellaneous</td>
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ISO viscosity class according to DIN ISO 3448, consistency grade according to DIN 51818, biodegradability according to OECD 301 F/B test after 28 days

1) Complies with requirements for Environmentally Acceptable Lubricants as defined in Appendix A of the 2013 Vessel General Permit.

2) Available from 2nd half of 2014.
The data in this document is based on our general experience and knowledge at the time of publication and is intended to give information of possible applications to a reader with technical experience. It constitutes neither an assurance of product properties nor does it release the user from the obligation of performing preliminary field tests with the product selected for a specific application. All data are guide values which depend on the lubricant’s composition, the intended use and the application method. The technical values of lubricants change depending on the mechanical, dynamical, chemical and thermal loads, time and pressure. These changes may affect the function of a component. We recommend contacting us to discuss your specific application. If possible we will be pleased to provide a sample for testing on request. Products from Klüber Lubrication are continually improved. Therefore, Klüber Lubrication reserves the right to change all the technical data in this document 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 80 years.