

your global specialist

Industrial sector

## Seaworthy.

A selection of lubricants for marine  
and offshore applications





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# The lubricant - a small investment that can make a big difference

You invest a lot of money in ships or offshore installations. Of course, you want these investments to pay off as soon as possible. Low operational and maintenance costs as well as reliable operation without malfunction or unplanned downtime are important cornerstones in this respect. Each service interval and each unplanned repair results in service costs and losses of income. One single day of standstill can cost several tens of thousands of dollars. Just imagine the bitter news of having to stop all operations to replace an important component after failure due to inadequate lubrication!

It is therefore vital to select the right lubricant. Lubricants may have a major impact on maintenance costs and the service life of components. Speciality lubricants from Klüber Lubrication are always a good choice. We work in close cooperation with manufacturers of important components and shipping industry equipment to extend service intervals and component lifetime whilst increasing operational reliability. The investment in a lubricant may be relatively small - but it can make a big difference.

## **Combine environmental and economic benefits with speciality lubricants from Klüber Lubrication**

Reducing the impact on the environment is important to the shipping and offshore industry. As a shipping operator, you will be aware of the expanding body of environmental regulations affecting your business. Additionally, a growing interest in ecological issues is driving your customers to demand environmentally sound operating practices.

Reducing the stream of mineral oil-based lubricants entering oceans, 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 through 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.



Klüber Lubrication manufactures a variety of biodegradable lubricants especially for the marine and offshore industries. A selection of our lubricants also comply with the stringent requirements of Environmentally Acceptable Lubricants (EAL) as defined in Appendix A of the 2013 Vessel General Permit.

### 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 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 Lubrication 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.

Our lubricants have proven effective in ships and platforms, some of them for decades. Many of our lubricants can be used for a variety of lubrication tasks. This helps you reduce the number of lubricants used on board your ships and the complexity of logistics processes and save time, money and storage capacity. If there is a part or component that you don't find in this brochure, just contact one of our specialists for advice.

### Unique testing facilities

Your specific requirements are our yardstick when developing speciality lubricants. Our unique testing facilities include more than 100 test rigs, some of which we developed ourselves for particular testing purposes.

In the lab we simulate the extreme stresses on the lubricant in the marine and offshore industries - variation in temperatures, high surface pressure, contact with salty air and seawater or micro-movements. During the test procedures, we load the components until damage occurs on the test rigs so as to determine the causes of failure. The results help us to develop the optimum lubricant in close cooperation with leading OEMs.







### **We are where you are**

It is our aim to offer you high-quality speciality lubricants and services around the globe along with the high technical competence Klüber Lubrication is known for. We meet this aim through our worldwide network of production and sales companies, competent dealers and through our highly specialised experts ready to respond to your individual requirements.

### **Klüber Lubrication - your reliable partner, always and everywhere**

We at Klüber Lubrication have decades of experience and know what your industry expects.

You need a lubricant supplier you can rely on. Someone who finds solutions also to extreme requirements to ensure your ship is up to its tasks, safe and reliable. You need experts on site to support you and to provide consultation and advice. And you need lubricants which can be supplied worldwide in the same high quality.

Klüber Lubrication offers this level of service. We developed a special service package for the marine and offshore industries:

- on-site support, provided by qualified experts
- personal technical advice and lubricant selection
- chemical analyses and tests in our in-house test facilities
- cost-benefit calculation
- worldwide availability of our lubricants in consistent high-quality
- new product development with added value
- lubrication training at your premises or our training centre

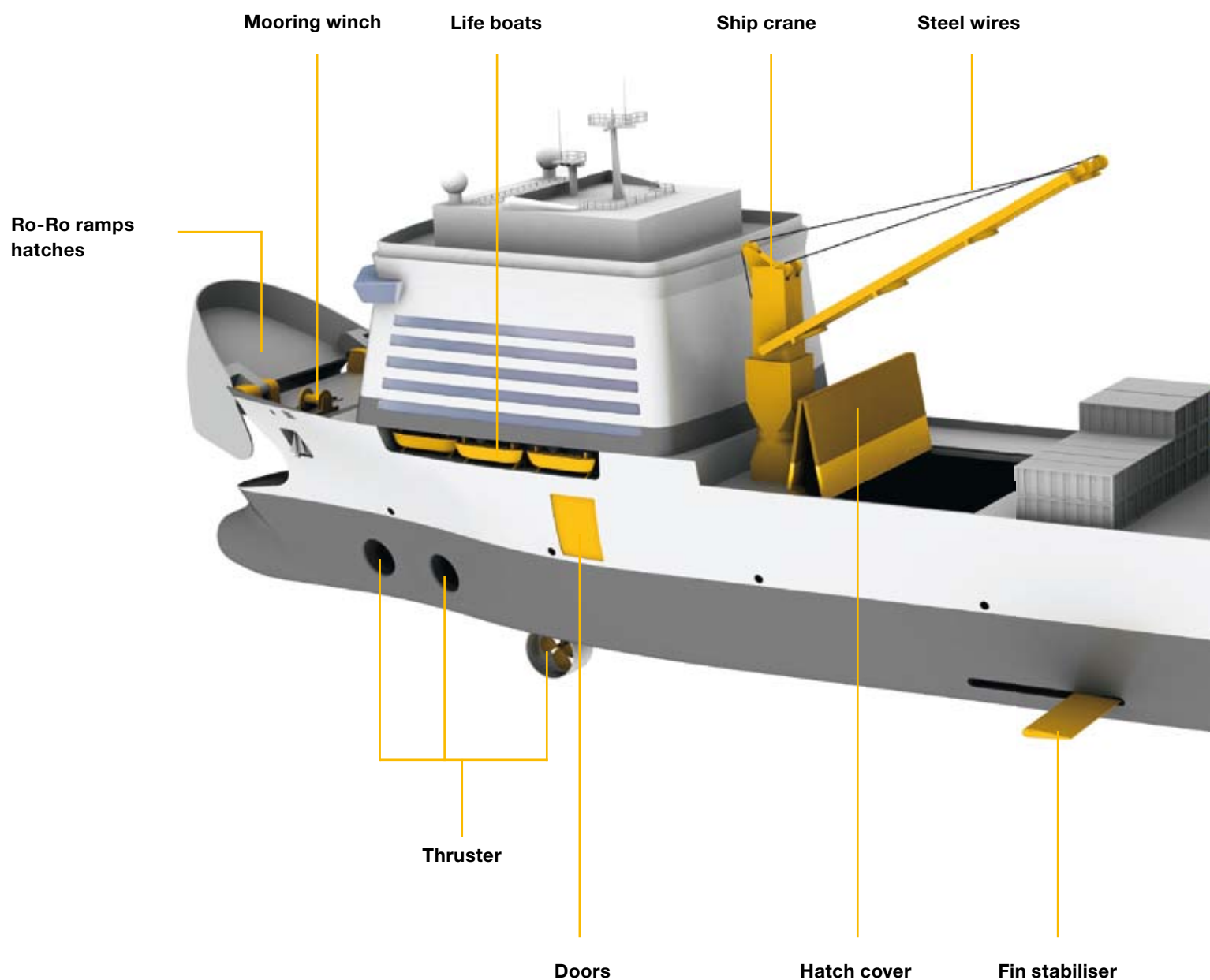
Wherever your ship may be: you can rely on our experienced experts who provide support and advice on lubrication and help you select the right lubricant worldwide.

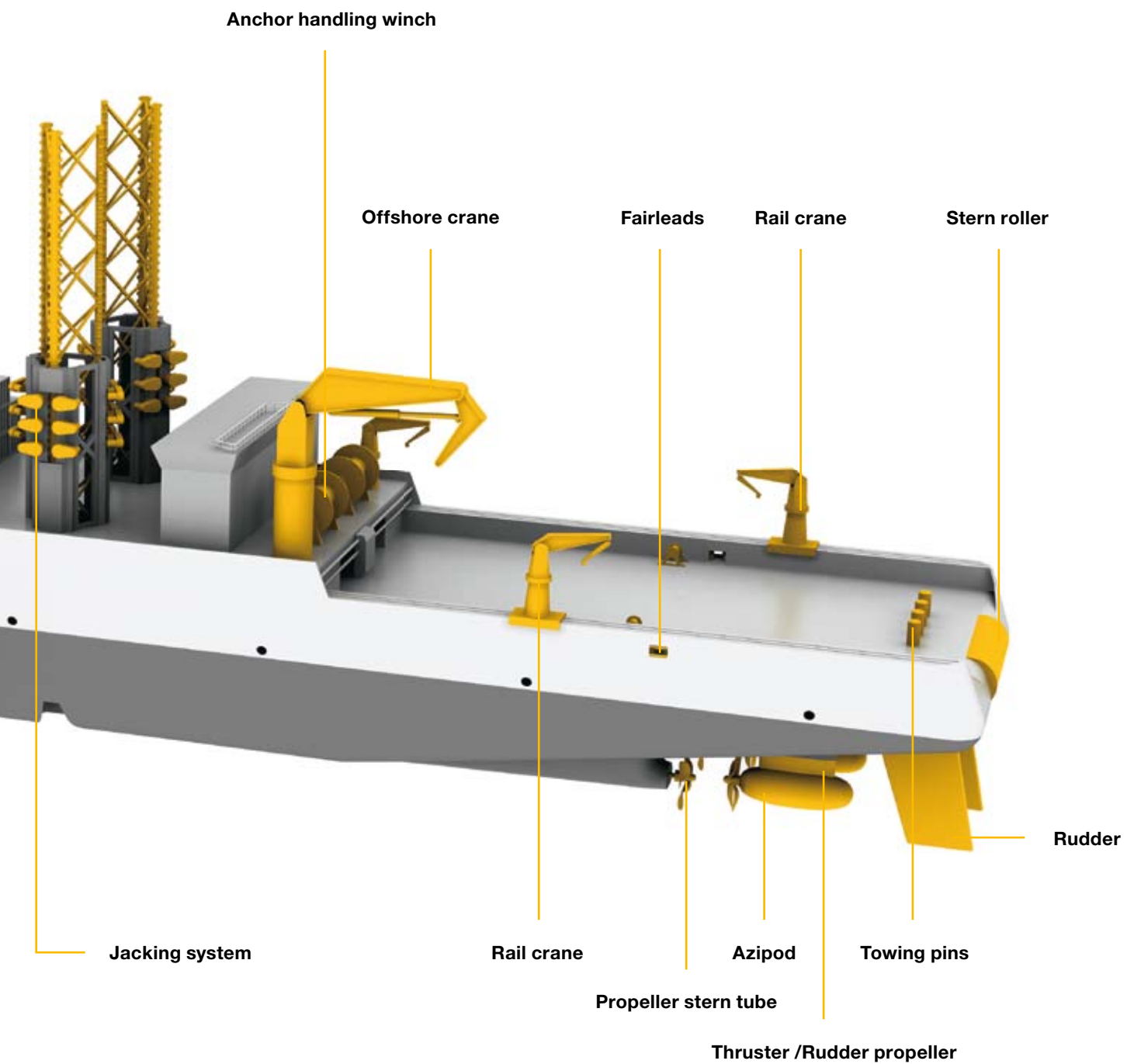
Make use of our experts' knowledge. We have the right solution for (almost) all requirements aboard a ship - and should we not have the right lubricant for you, we'll develop it.

Test us!



## Application overview: Optimally equipped with our speciality lubricants





# Selected lubricants for ships and offshore platforms from Klüber Lubrication

| Module                      | Component/lubrication point                      |
|-----------------------------|--|
| Diesel engine               | Screws on turbocharger                           |
|                             | Open gears on flywheels                          |
| Power transmission          | Marine reduction gearboxes                       |
|                             | Enclosed gearboxes (general)                     |
|                             | Curved tooth gear couplings - oil lubrication    |
|                             | Curved tooth gear couplings - grease lubrication |
|                             | Split roller bearings for propeller shafts       |
| Azipod                      | Slewing bearing with gear teeth                  |
|                             | Sealing grease for steering shaf seals           |
|                             | Thrust bearing (Azipod X)                        |
|                             | Thrust bearing (Azipod V)                        |
|                             | Propeller shaft bearing (Azipod V and X)         |
|                             | Propeller shaft seal (Azipod X)                  |
| Compact Azipod              | Slewing bearing                                  |
|                             | Gear teeth on slewing bearing                    |
|                             | Thrust bearing                                   |
|                             | Propeller shaft bearing                          |
| Thruster / Rudder propeller | Gears and bearings                               |
|                             | Steering shaft seal                              |





| Differentiation  | Speciality lubricant                                  |
|--|---|
|  | Klüberpaste HEL 46-450                                |
| Highly viscous adhesive lubricant  | Klüberfluid C-F 3 ULTRA                               |
| Adhesive grease  | Klüberplex AG 11-462                                  |
| Mineral oil-based lubricant  | Klüberoil GEM 1-100 N /150 N                          |
| Synthetic high-performance gear oil offering longer service life than mineral oil  | Klübersynth GEM 4-100 N /150 N                        |
| Mineral oil-based lubricant  | Klüberoil GEM 1-100 N /150 N /220 N                   |
| Synthetic high-performance gear oil offering longer service life than mineral oil  | Klübersynth GEM 4-100 N /150 N /220 N                 |
| Readily biodegradable synthetic oil for high requirements offering longer service life than mineral oil  | Klüberbio EG 2-100 /150<br>Klübersynth GEM 2-220 /320 |
| Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit, synthetic, readily biodegradable gear oil       | Klüberbio EG 2-68 /100 /150                           |
| High base oil viscosity<br>With solid lubricant  | STRUCTOVIS BHD MF                                     |
| Low base oil viscosity<br>Without solid lubricant  | Klüberoil GEM 1-460 N                                 |
| Very soft fluid grease with solid lubricant  | GRAFLOSCON C-SG 500 PLUS                              |
| Soft heavy-duty grease with solid lubricant  | Klüberlub BE 41-1501                                  |
| Very soft fluid grease without solid lubricant   | Klüberplex GE 11-680<br>Klüberplex BEM 41-132         |
| Standard viscosity according to ABB Marine lubrication chart   | Klübersynth GEM 4-320 N                               |
| Very high base oil viscosity to prevent lubricant leakage via the rotating shaft seals   | Klüberfluid C-F 3 ULTRA                               |
| Mineral oil-based grease   | STABURAGS NBU 30                                      |
| Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit, readily biodegradable grease                    | Klüberbio AG 39-602                                   |
|  | Klübersynth GEM 4-150 N                               |
|  | Klübersynth GEM 4-320 N                               |
|  | Klübersynth GEM 4-320 N                               |
| Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit, synthetic, readily biodegradable stern tube oil | Klüberbio RM 2-150                                    |
|  | MICROLUBE GL 262                                      |
|  | GRAFLOSCON C-SG 0 ULTRA                               |
|  | Klübersynth GEM 4-320 N                               |
|  | MICROLUBE GL 262                                      |
| Standard lubricant based on mineral oil with excellent scuffing load capacity  | Klüberoil GEM 1-100 N /150 N                          |
| Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit, synthetic, readily biodegradable gear oil       | Klüberbio EG 2-68 /100 /150                           |
| Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit, readily biodegradable grease                    | Klüberbio AG 39-602                                   |

# Selected lubricants for ships and offshore platforms from Klüber Lubrication

| Module                                 | Component/lubrication point  |
|--|--|
| Fixed and controllable pitch propeller | Stern tubes  |
| Rudder                                 | Bearings and seals   |
| Anchor winch/Mooring winch             | Open gears<br>Running-in lubricant   |
|  | Open gears<br>Operational lubricant for use in central lubrication systems                       |
|  | Open gears<br>Operational lubricant for use in central lubrication systems or manual lubrication |
|  | Enclosed gearboxes   |
|  | Bearings - rolling bearings  |
|  | Bearings - plain bearings  |
|  | Anchor winch spooling devices  |
|  | Hydraulic motors   |

<sup>1)</sup> Available from 2nd half of 2014

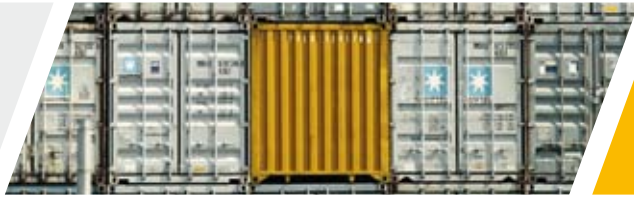


| Differentiation   | Speciality lubricant              |
|---|-----------------------------------|
| For all purpose operation, Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit, synthetic, readily biodegradable stern tube oil               | Klüberbio RM 2-100                |
| For continuous operation in the tropics, Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit, synthetic, readily biodegradable stern tube oil | Klüberbio RM 2-150                |
| Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit, readily biodegradable grease   | Klüberbio AG 39-602               |
|   | GRAFLOSCON B-SG 00 ULTRA          |
| Highly viscous adhesive lubricating oil for ambient temperatures above -10 °C (14 °F)   | Klüberfluid C-F 4 ULTRA           |
| Highly viscous adhesive lubricant for ambient temperatures above 5 °C (41 °F)   | Klüberfluid C-F 3 ULTRA           |
| Highly viscous adhesive lubricant for ambient temperatures above 30 °C (86 °F)  | Klüberfluid C-F 3 M ULTRA         |
| Readily biodegradable fluid grease for ambient temperatures down to -30 °C (-22 °F)   | Klüberbio LG 39-700               |
| Very soft adhesive grease<br>Applicable through central lubrication systems at ambient temperatures down to approx. -10 °C (14 °F)  | Klüberplex AG 11-461              |
| Soft adhesive grease<br>Applicable through central lubrication systems at ambient temperatures down to approx. 0 °C (32 °F)   | Klüberplex AG 11-462              |
| Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit, readily biodegradable grease   | Klüberbio AG 39-602               |
|   | Klübersynth GEM 4-220 N /320 N    |
| Readily biodegradable   | Klübersynth GEM 2-220 /320        |
| For low-speed, highly loaded rolling bearings   | Klüberplex AG 11-462              |
| For low and high-speed rolling bearings<br>Also for low temperatures  | Klüberplex BEM 41-132             |
| Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit, readily biodegradable grease   | Klüberbio BM 32-142 <sup>1)</sup> |
| For highly loaded, low-speed plain bearings   | Klüberplex AG 11-462              |
| For low and high-speed plain bearings<br>Also at low temperatures   | Klüberplex BEM 41-132             |
| Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit, readily biodegradable grease   | Klüberbio AG 39-602               |
|   | Klüberplex AG 11-462              |
| Based on mineral oil  | LAMORA HLP 32 /46 /68             |
| Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit, synthetic, readily biodegradable hydraulic oil   | Klüberbio LR 9-32 /46 /68         |

## Selected lubricants for ships and offshore platforms from Klüber Lubrication

| Module                         | Component/lubrication point   |
|--------------------------------|---|
| Fairleads                      | Bearings - plain bearings   |
| Deck, rail and offshore cranes | Open gears at slewing bearings and drive pinions, toothrack and pinions |
|                                | Open gears on hoisting winches  |
|                                | Bearings - rolling bearings   |
|                                | Bearings - plain bearings   |
|                                | Enclosed gears  |
|                                | Hydraulic engines/cylinders   |
| Towing pins and shark jaws     | Bronze plain bearings/bushings  |
| Container lashing supplies     | Twistlock   |
|                                | Turnbuckle threads (container lashing)                                  |
| Hatch cover and Ro-Ro-ramps    | Hydraulic engines and cylinders   |
|                                | Plain bearings and bushings   |
| Stern roller                   | Plain bearings  |
| Life boats                     | Bearings  |

<sup>1)</sup> Available from 2nd half of 2014



| Differentiation   | Speciality lubricant              |
|---|-----------------------------------|
| For highly loaded, low-speed plain bearings   | Klüberplex AG 11-462              |
| For low and high-speed plain bearings<br>Also at low temperatures   | Klüberplex BEM 41-132             |
| Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit, readily biodegradable grease                   | Klüberbio BM 32-142 <sup>1)</sup> |
| Based on mineral oil  | Klüberplex AG 11-462              |
| Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit, readily biodegradable grease                   | Klüberbio AG 39-602               |
| Very soft adhesive grease<br>Applicable through central lubrication systems at ambient temperatures down to approx. -10 °C (14 °F)              | Klüberplex AG 11-461              |
| Soft adhesive grease<br>Applicable through central lubrication systems at ambient temperatures down to approx. 0 °C (32 °F)                     | Klüberplex AG 11-462              |
| Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit, readily biodegradable grease                   | Klüberbio AG 39-602               |
| For low-speed, highly loaded rolling bearings   | Klüberplex AG 11-462              |
| For low and high-speed rolling bearings<br>Also for low temperatures  | Klüberplex BEM 41-132             |
| Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit, readily biodegradable grease                   | Klüberbio BM 32-142 <sup>1)</sup> |
| For highly loaded, low-speed plain bearings   | Klüberplex AG 11-462              |
| For low and high-speed plain bearings<br>Also at low temperatures   | Klüberplex BEM 41-132             |
| Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit, readily biodegradable grease                   | Klüberbio AG 39-602               |
|   | Klübersynth GEM 4-100 N /150 N    |
| Based on mineral oil  | LAMORA HLP 32 /46 /68             |
| Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit, synthetic, readily biodegradable hydraulic oil | Klüberbio LR 9-32 /46 /68         |
|   | Klüberplex AG 11-462              |
| Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit, readily biodegradable grease                   | Klüberbio AG 39-602               |
|   | Klüberplex BE 11-462              |
|   | Klüberplex AG 11-462              |
| Based on mineral oil  | LAMORA HLP 32 /46 /48             |
| Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit, synthetic, readily biodegradable hydraulic oil | Klüberbio LR 9-32 /46 /68         |
|   | Klüberplex AG 11-462              |
| Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit, readily biodegradable grease                   | Klüberbio AG 39-602               |
|   | Klüberbio LG 39-700               |
| Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit, readily biodegradable grease                   | Klüberbio AG 39-602               |



## Selected lubricants for ships and offshore platforms from Klüber Lubrication

| Module  | Component/lubrication point                    |
|---|--|
| Jacking system                                  | Toothrack and pinions                          |
|   | Planetary gearbox                              |
| Compressors                                     | Gas screw compressor                           |
|   | Gas piston compressor                          |
|   | Screw and piston compressors for refrigeration |
|   | Compressed air screw compressor                |
| Electric motors/Alternators                     | Compressed air piston compressor               |
|   | Electric motor bearings<br>Alternator bearings |
| Chains  | Chains - grease lubrication                    |
|   | Chains - oil lubrication                       |
| Steel cables wire ropes                         | Steel cables wire ropes                        |
| Assembly lubricants for<br>all types of modules | Assembly paste for screws                      |
|   | Assembly paste for steel screws                |
| Fin stabiliser                                  | Shaft bearings and rigging axis bearings       |
|   | Hydraulic power unit                           |



| Differentiation   | Speciality lubricant                |
|---|-------------------------------------|
| Usable for automatic lubrication systems  | Klüberbio LG 39-700                 |
| Manual lubrication, Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit, readily biodegradable grease | Klüberbio AG 39-602                 |
|   | Klübersynth GEM 2-320               |
|   | Klüber Summit PGS 68 /100 /150 /220 |
| For sour process gases<br>Applicable in both piston and screw compressors   | Klüber Summit PGS 68 /100 /150 /220 |
| Optimised for oil-injected high-pressure reciprocating compressors  | Klüber Summit NGL 444 /888          |
| For refrigeration compressors using CO <sub>2</sub> or ammonia as refrigerant   | Klüber Summit R 100 /200 /300       |
| For refrigeration compressors using hydrocarbon-based refrigerants, e.g. propane, butane, propylene   | Klüber Summit PGI 68 /100 /150      |
|   | Klüber Summit SH 32 /46 /68         |
|   | Klüber Summit DSL 68 /100 /125      |
|   | Klüberplex BEM 41-132               |
|   | GRAFLOSCON CA 901 ULTRA SPRAY       |
| With solid lubricant  | STRUCTOVIS BHD MF                   |
| Without solid lubricant<br>With hydrocapillary effect (displaces humidity/water)  | STRUCTOVIS BHD 75 S                 |
|   | Klüberplex AG 11-462                |
| Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit, readily biodegradable grease                     | Klüberbio AG 39-602                 |
|   | Klüberpaste 46 MR 401               |
|   | Klüberpaste HEL 46-450              |
| Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit, synthetic, readily biodegradable gear oil        | Klüberbio EG 2-100 /150             |
| Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit, synthetic, readily biodegradable hydraulic oil   | Klüberbio LR 9-32 /46 /68           |

## Details on the lubricants (products in alphabetical order)

| Klüber speciality lubricant         | Application notes and product description  |
|-------------------------------------|--|
| GRAFLOSCON B-SG 00 ULTRA            | Running-in lubricant for open gears.<br>Tooth flanks are levelled by means of controlled micro wear under load during operation.<br>An increased contact ratio of the load-carrying tooth flanks of approx. 80 % can be obtained, largely avoiding overloads and gear damage.<br>Once running-in is completed, change over to operational lubrication. The changeover can be undertaken without prior cleaning.<br>Please use GRAFLOSCON B-SG 00 ULTRA as running-in lubricant only! |
| GRAFLOSCON CA 901 ULTRA SPRAY       | Graphite-containing adhesive lubricant for external lubrication of chains and wire ropes.<br>The product is very adhesive, high-pressure resistant and provides good corrosion protection. It has good emergency lubricating properties owing to solid lubricants. The handy spray can makes its application easy and comfortable.   |
| GRAFLOSCON C-SG 0 ULTRA             | Tried-and-tested operational lubricant for highly loaded gear teeth ensuring long drive lifetime at low lubricant consumption, hence contributing to operating cost savings.<br>The lubricant has been approved by ABB Marine for the lubrication of the Compact Azipod slewing bearings.  |
| GRAFLOSCON C-SG 500 PLUS            | Very soft fluid grease providing good adhesion and pressure-absorption capacity. High operational reliability through solid lubricant with emergency lubricating properties.   |
| Klüber Summit DSL 68 /100 /125      | Synthetic air compressor oil.<br>Significantly longer lifetime of valves and piston rings compared to mineral oil and hydrocarbon-based oils due to lower residue formation, reducing costs for maintenance and failures.<br>Its low friction coefficient leads to higher energy efficiency.   |
| Klüber Summit NGL 444 /888          | Synthetic compressor oil for the lubrication of cylinders in oil-injected high-pressure piston compressors. Cost reduction due to longer service life of valves and piston rings. Compared to mineral oils, the product is very resistant to dilution and absorption by hydrocarbon-containing gases.  |
| Klüber Summit PGI 68 /100 /150      | Synthetic compressor oil for oil-injected process gas compressors operated with refrigerants based on hydrocarbon (propane, butane, propylene, etc.).<br>Very resistant to dilution and absorption by hydrocarbon-containing gases compared to mineral oils.<br>Its longer oil lifetime reduces costs.   |
| Klüber Summit PGS 68 /100 /150 /220 | Synthetic compressor oil for oil-injected process gas compressors. Low drop in viscosity owing to low solubility in gases. Particularly suitable for applications involving H <sub>2</sub> S.  |
| Klüber Summit R 100 /200 /300       | Synthetic refrigerator oil particularly suitable for highly loaded ammonia and CO <sub>2</sub> refrigeration compressors. Good compatibility with ammonia. High efficiency of the refrigeration installation due to few oil-related residues. Good viscosity-temperature behaviour.  |

<sup>1)</sup> Consistency grade according to DIN 51818

<sup>2)</sup> Base oil viscosity at 40 °C (104 °F) according to DIN 51562 part 1/ASTM D-445/ASTM D-7042



| Chemical composition  | Technical data  |
|---|---|
| Mineral oil<br>Aluminium soap<br>Solid lubricant (graphite)         | <ul style="list-style-type: none"> <li>– Consistency grade<sup>1)</sup>: NLGI 00</li> <li>– Base oil viscosity<sup>2)</sup>: approx. 500 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: 0 to 90 °C (5 to 194 °F)</li> <li>– Effectiveness of the lubricant film down to –30 °C (–22 °F)</li> </ul>    |
| Mineral oil<br>Aluminium complex soap<br>Solid lubricant (graphite) | <ul style="list-style-type: none"> <li>– Consistency grade<sup>1)</sup>: NLGI 1</li> <li>– Service temperature range approx.: 0 to 120 °C (32 to 248 °F)</li> </ul>   |
| Mineral oil<br>Aluminium soap<br>Solid lubricant (graphite)         | <ul style="list-style-type: none"> <li>– Consistency grade<sup>1)</sup>: NLGI 0</li> <li>– Base oil viscosity<sup>2)</sup>: approx. 680 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: 0 to 90 °C (32 to 194 °F)</li> <li>– Effectiveness of the lubricating film down to –30 °C (–22 °F)</li> </ul>  |
| Mineral oil<br>Aluminium complex soap<br>Solid lubricant (graphite) | <ul style="list-style-type: none"> <li>– Consistency grade<sup>1)</sup>: NLGI 0</li> <li>– Base oil viscosity<sup>2)</sup>: approx. 680 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: 0 to 120 °C (32 to 248 °F)</li> <li>– Effectiveness of the lubricating film down to –30 °C (–22 °F)</li> </ul> |
| Synthetic ester oil   | <ul style="list-style-type: none"> <li>– Base oil viscosity<sup>2)</sup>: approx. 68/100/125 mm<sup>2</sup>/s</li> <li>– Please observe viscosity recommendations by the compressor manufacturer.</li> </ul>  |
| Polyalkylene glycol oil   | <ul style="list-style-type: none"> <li>– Base oil viscosity<sup>2)</sup>: approx. 80 or approx. 220 mm<sup>2</sup>/s respectively</li> <li>– Viscosity is to be selected according to the application (composition of the gas flow). We will be pleased to assist you.</li> </ul>                                     |
| Polyalkylene glycol oil   | <ul style="list-style-type: none"> <li>– Base oil viscosity<sup>1)</sup>: approx. 68/100/150 mm<sup>2</sup>/s</li> <li>– Viscosity is to be selected according to the application (refrigerant, pressure, temperature). We will be pleased to assist you.</li> </ul>  |
| Polyalkylene glycol oil   | <ul style="list-style-type: none"> <li>– Base oil viscosity<sup>2)</sup>: approx. 68/100/150/220 mm<sup>2</sup>/s</li> <li>– Viscosity is to be selected according to the application (composition of the gas flow). We will be pleased to assist you.</li> </ul>   |
| Synthetic hydrocarbon oil   | <ul style="list-style-type: none"> <li>– Base oil viscosity<sup>2)</sup>: approx. 32/68/100 mm<sup>2</sup>/s</li> <li>– Viscosity is to be selected according to the application (refrigerant, pressure, temperature). We will be pleased to assist you.</li> </ul>   |

# Details on the lubricants (products in alphabetical order)

| Klüber speciality lubricant       | Application notes and product description   |
|-----------------------------------|---|
| Klüberbio AG 39-602               | Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit with EU Ecolabel, adhesive lubricating grease for open gears and steel wire ropes. <ul style="list-style-type: none"> <li>– Very good adhesion, also at high temperatures (e.g. intensive sunlight, tropical climate zones)</li> <li>– No dripping or flinging off, reducing lubricant consumption</li> <li>– Very good water resistance and good corrosion protection in contact with sea water</li> </ul>   |
| Klüberbio BM 32-142 <sup>1)</sup> | Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit with EU Ecolabel, fully synthetic, readily biodegradable special lubricating grease. Klüberbio BM 32-142 has a good sealing effect due to its excellent resistance to water. It protects against corrosion, has a good pressure absorption capacity and offers high ageing resistance. The product can be used for both low and medium speed bearings   |
| Klüberbio EG 2-68 /100 /150       | Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit with EU Ecolabel, synthetic, readily biodegradable high-performance gear oil offering the following characteristics: <ul style="list-style-type: none"> <li>– Non-toxic to marine organisms. Therefore less environmental impact in the event of leakage</li> <li>– Significantly longer oil lifetime than mineral oil due to excellent ageing and oxidation stability</li> <li>– Sufficient protection against fretting damage of gears, also under high peak loads due to high scuffing load capacity</li> <li>– Approved by leading propeller shaft seal manufacturers<sup>2)</sup></li> </ul> |
| Klüberbio LG 39-700               | Readily biodegradable adhesive lubricant for highly loaded gears. Excellent low-temperature behaviour enables operation of open gear drives with centralised lubricating systems in areas with very low ambient temperatures.   |
| Klüberbio LR 9-32 /46 /68         | Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit with EU Ecolabel, synthetic, readily biodegradable hydraulic oil Klüberbio LR 9 oils meet or even exceed the requirements stipulated in ISO 15380, Bosch Rexroth RE 90221-01 and Swedish Standard SS 15 54 34.  |
| Klüberbio RM 2-100 /150           | Environmentally Acceptable Lubricant as defined in Appendix A of the 2013 Vessel General Permit with EU Ecolabel, synthetic, readily biodegradable stern tube oil suitable for lubrication of propeller shaft bushings. <ul style="list-style-type: none"> <li>– Non-toxic to marine organisms. Therefore less environmental impact in the event of leakage.</li> <li>– Approved by leading propeller shaft seal manufacturers<sup>2)</sup></li> </ul>  |
| Klüberfluid C-F 3 M ULTRA         | Highly viscous, transparent operational lubricant for open gears with good adhesion, good load-carrying capacity, good wear protection and very high scuffing resistance. Optimised for use with anchor winches at ambient temperatures above 30 °C (86 °F). No dripping in tropical climate zones. Higher base oil viscosity than Klüberfluid C-F 3 ULTRA. Rolls Royce Marine has approved Klüberfluid C-F 3 M ULTRA for the lubrication of large anchor winches at high ambient temperatures.   |
| Klüber Summit SH 32 /46 /68       | Synthetic air compressor oil for low maintenance and operational costs due to longer oil change intervals. Low formation of oxidation residues in the oil circuit. Longer lifetime of oil filters and separators compared to mineral oils.  |

<sup>1)</sup> Available from 2nd half of 2014

<sup>2)</sup> Please contact Klüber Lubrication or the seal manufacturer for technical consultation on your specific seal-lubricant combination. Please bear in mind that elastomer materials used in radial shaft seals can behave differently. Therefore, compatibility tests with the products have to be conducted prior to application.

<sup>3)</sup> Consistency grade according to DIN 51818

<sup>4)</sup> Base oil viscosity at 40 °C (104 °F) according to DIN 51562 part 1/ASTM D-445/ASTM D-7042





|  | Chemical composition  | Technical data   |
|--|---|--|
|  | Ester oil<br>Calcium soap   | <ul style="list-style-type: none"> <li>– Consistency grade<sup>3)</sup>: NLGI 2</li> <li>– Base oil viscosity<sup>4)</sup>: approx. 600 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: –20 to 100 °C (–4 to 212 °F)</li> <li>– Biodegradability according to OECD 301 F test after 28 days &gt; 60 %</li> <li>– Viscosity to be selected depends on application</li> </ul> |
|  | Synthetic ester oil<br>Calcium soap   | <ul style="list-style-type: none"> <li>– Consistency grade<sup>3)</sup>: NLGI 2</li> <li>– Base oil viscosity<sup>4)</sup>: approx. 140 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: –40 to 120 °C (–40 to 248 °F)</li> <li>– Biodegradability in the OECD 301 F test after 28 days &gt; 60 %</li> </ul>   |
|  | Synthetic ester oil   | <ul style="list-style-type: none"> <li>– Base oil viscosity<sup>4)</sup>: approx. 68/ 100/ 150 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: –25 to 100 °C (–13 to 212 °F)</li> <li>– Biodegradability according to OECD 301 F test after 28 days &gt; 60 %</li> </ul>  |
|  | High-viscosity ester oil based on<br>100 % renewable raw materials,<br>calcium soap,<br>solid lubricant | <ul style="list-style-type: none"> <li>– Consistency grade<sup>3)</sup>: NLGI 0</li> <li>– Base oil viscosity<sup>4)</sup>: approx. 680 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: –30 to 100 °C (–22 to 212 °F)</li> <li>– Biodegradability in the CEC-TDL-L-103 test after 21 days &gt; 70 %</li> </ul>  |
|  | Synthetic ester oil   | <ul style="list-style-type: none"> <li>– Base oil viscosity<sup>4)</sup>: approx. 32 / 46 / 68 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: –40 to 80 °C (–40 bis 176 °F)</li> <li>– Biodegradability in the OECD 301 B test after 28 days &gt; 60 %.</li> <li>– Viscosity to be selected depends on application</li> </ul>  |
|  | Synthetic ester oil   | <ul style="list-style-type: none"> <li>– Base oil viscosity<sup>4)</sup>: approx. 100 / 150 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: –10 to 100 °C (14 to 212 °F)</li> <li>– Biodegradability in the OECD 301 F test after 28 days &gt; 60 %</li> </ul>  |
|  | Mineral oil<br>Synthetic hydrocarbon oil  | <ul style="list-style-type: none"> <li>– Base oil viscosity<sup>4)</sup>: &gt; 25 000 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: 25 to 100 °C (77 to 212 °F)</li> <li>– Effectiveness of the lubricant film down to 0 °C (32 °F)</li> </ul>  |
|  | Synthetic hydrocarbon oil<br>Synthetic ester oil  | <ul style="list-style-type: none"> <li>– Base oil viscosity<sup>4)</sup>: approx. 32 / 46 / 68 mm<sup>2</sup>/s</li> <li>– Please observe the viscosity specification by the compressor manufacturer.</li> </ul>   |

# Details on the lubricants (products in alphabetical order)

| Klüber speciality lubricant         | Application notes and product description   |
|-------------------------------------|---|
| Klüberfluid C-F 3 ULTRA             | Highly viscous, transparent operational lubricant for open gears with good adhesion, good load-carrying capacity, good wear protection and very high scuffing resistance. Optimised for use on anchor winches at ambient temperatures of 5 to 30 °C (41 to 86 °F). Longer component lifetime owing to tooth flank protection. Lubricant consumption can be reduced by 20-25 % compared to graphite-containing adhesive lubricants. No oil leakages at the steering shaft seals due to its high viscosity when used in Azipods. Klüberfluid C-F 3 ULTRA has therefore been approved by ABB Marine for the lubrication of slewing bearings. Wärtsilä has also approved this lubricant for the lubrication of gear teeth at the flywheel of all two-stroke diesel engines of the model series RTA from 1981 onwards and RT-flex from approx. 1998 onwards. Rolls Royce Marine has approved it for the lubrication of gear teeth on large anchor winches. |
| Klüberfluid C-F 4 ULTRA             | Transparent operational lubricant for open gears with good adhesion, good load-carrying capacity, good wear protection and very high scuffing resistance. Optimised for use on anchor winches at ambient temperatures of -10 to 5 °C (14 to 41 °F). Lower base oil viscosity than Klüberfluid C-F 3 ULTRA. Rolls Royce Marine has approved Klüberfluid C-F 4 ULTRA for the lubrication of gear teeth on large anchor winches at low ambient temperatures.   |
| Klüberlub BE 41-1501                | Heavy-duty grease with good adhesion (stiffer than GRAFLOSCON C-SG 500 PLUS). Solid lubricant with emergency lubricating properties for high operational reliability.   |
| Klüberoil GEM 1-100 N /150 N /220 N | High-performance gear and multipurpose oils based on mineral oil with high scuffing resistance, good ageing and oxidation stability and high wear protection. Viscosity is to be selected according to the application.   |
| Klüberoil GEM 1-460 N               | High-performance gear and multipurpose oils based on mineral oil with good ageing and oxidation stability and high wear protection. High scuffing resistance also at high peak loads, vibrations and oscillations.  |
| Klüberpaste 46 MR 401               | High-performance, white lubricating paste for positive and power-locking connections, e.g. screws on propeller blades. Its high pressure absorption capacity protects against wear, also under high surface pressure. The product reduces wear caused by vibrations and protects against tribocorrosion. Klüberpaste 46 MR 401 is water and leach-resistant, facilitating long-term lubrication. Its good corrosion protection increases component lifetime.  |
| Klüberpaste HEL 46-450              | Black lubricating and assembly paste for bolted connections and connections at the turbocharger and exhaust gas lines. Facilitates easy loosening of bolted connections also after high and long-lasting thermal load. Dry lubrication is attained at temperatures above 200 °C (392 °F).   |
| Klüberplex AG 11-461                | White adhesive lubricating grease for open gears with very good load-carrying capacity and wear protection. The product has the same properties as Klüberplex AG 11-462, but its consistency is softer. Applicable through central lubrication systems down to approx. -10°C (14 °F).   |
| Klüberplex AG 11-462                | White adhesive grease for open gears with very good load-carrying capacity and very good wear protection due to selected solid lubricants and additives. Good wear protection, also for highly loaded rolling and plain bearings at low speeds (not suitable for high speed factors). Very good adhesion, also at high temperatures (e.g. intense sunlight, tropical climate zones). No dripping or flinging off, reducing lubricant consumption. Very good water resistance and good corrosion protection in contact with seawater. Its white colour facilitates simple checks of load-carrying patterns (as it is the contrast to the dark tooth flank surface). Applicable through central lubrication systems down to approx. 0 °C (32 °F). Also available as spray. Clean handling, particularly suitable as rope lubricant for cruise ships as it is white and free from graphite.  |
| Klüberplex BE 11-462                | Rolling and plain bearing grease offering good wear protection, very good adhesion and good corrosion protection. The grease is therefore applicable for the lubrication of twistlocks to increase their reliability (quick and easy locking and unlocking when loading or unloading containers). The product is also available as spray for easy relubrication.  |

<sup>1)</sup> Consistency grade according to DIN 51818

<sup>2)</sup> Base oil viscosity at 40 °C (104 °F) according to DIN 51562 part 1/ASTM D-445/ASTM D-7042



|  | Chemical composition   | Technical data  |
|--|--|---|
|  | Mineral oil<br>Synthetic hydrocarbon oil   | <ul style="list-style-type: none"> <li>– Base oil viscosity<sup>2)</sup>: approx. 16 500 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: 0 to 120 °C (32 to 248 °F)</li> <li>– Effectiveness of the lubricating film down to –30 °C (–22 °F)</li> </ul>  |
|  | Mineral oil<br>Synthetic hydrocarbon oil<br>Synthetic ester oil                            | <ul style="list-style-type: none"> <li>– Base oil viscosity<sup>2)</sup>: approx. 3 100 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: 0 to 80 °C (32 to 176 °F)</li> <li>– Effectiveness of the lubricating film down to –30 °C (–22 °F)</li> </ul>  |
|  | Mineral oil<br>Lithium complex soap<br>Solid lubricants<br>(MoS <sub>2</sub> and graphite) | <ul style="list-style-type: none"> <li>– Consistency grade<sup>1)</sup>: NLGI 1</li> <li>– Base oil viscosity<sup>2)</sup>: approx. 1 500 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: –10 to 150 °C (14 to 302 °F)</li> </ul>  |
|  | Mineral oil  | <ul style="list-style-type: none"> <li>– Base oil viscosity<sup>2)</sup>: approx. 100/150/220 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: –5 to 100 °C (23 to 212 °F)</li> </ul>   |
|  | Mineral oil  | <ul style="list-style-type: none"> <li>– Base oil viscosity<sup>2)</sup>: approx. 460 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: 0 to 100 °C (32 to 212 °F)</li> </ul>  |
|  | Polyglycol oil<br>Lithium soap<br>Solid lubricant  | <ul style="list-style-type: none"> <li>– Consistency grade<sup>1)</sup>: NLGI 0</li> <li>– Base oil viscosity<sup>2)</sup>: 350 to 375 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: –40 to 150 °C (–40 to 302 °F)</li> </ul>  |
|  | Synthetic hydrocarbon oil<br>Synthetic ester oil<br>Solid lubricant                        | <ul style="list-style-type: none"> <li>– Consistency grade<sup>1)</sup>: NLGI 1</li> <li>– Base oil viscosity<sup>2)</sup>: approx. 42 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: –40 to 1 000 °C (–40 to 1832 °F), dry lubrication above 200 °C</li> </ul>   |
|  | Mineral oil<br>Aluminium complex soap<br>White solid lubricant                             | <ul style="list-style-type: none"> <li>– Consistency grade<sup>1)</sup>: NLGI 1</li> <li>– Base oil viscosity<sup>2)</sup>: approx. 460 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: –10 to 150 °C (14 to 302 °F)</li> <li>– Effectiveness of the lubricating film down to –40 °C (–40 °F)</li> </ul> |
|  | Mineral oil<br>Aluminium complex soap<br>White solid lubricant                             | <ul style="list-style-type: none"> <li>– Consistency grade<sup>1)</sup>: NLGI 2</li> <li>– Base oil viscosity<sup>2)</sup>: approx. 460 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: –10 to 150 °C (14 to 302 °F)</li> <li>– Effectiveness of the lubricating film down to –40 °C (–40 °F)</li> </ul> |
|  | Mineral oil<br>Aluminium complex soap  | <ul style="list-style-type: none"> <li>– Consistency grade<sup>1)</sup>: NLGI 2</li> <li>– Base oil viscosity<sup>2)</sup>: approx. 500 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: –15 to 140 °C (5 to 302 °F)</li> </ul>   |

# Details on the lubricants (products in alphabetical order)

| Klüber speciality lubricant                 | Application notes and product description  |
|---|--|
| Klüberplex BEM 41-132                       | <p>Very versatile long-term lubricating grease, especially for rolling bearings with a high percentage of sliding friction (e.g. cylindrical roller bearings).</p> <p>It can be used for both low and high-speed bearings subject to high or low temperatures.</p> <p>Another possible use is the long-term lubrication of traction motor bearings. The special additivation extends component lifetime.</p> <p>Low maintenance requirements due to the long grease lifetime.</p> <p>The product offers good water resistance and good corrosion protection in contact with seawater.</p>  |
| Klüberplex GE 11-680                        | <p>Very soft fluid grease offering good adhesion without solid lubricants.</p> <p>It is high-pressure resistant, contains wear-minimising additives and corrosion and oxidation inhibitors.</p>  |
| Klübersynth GEM 2-220 /320                  | <p>Synthetic, readily biodegradable high-performance gear oil offering the following advantages over mineral oil of the same viscosity:</p> <ul style="list-style-type: none"> <li>– Significantly longer oil lifetime due to excellent ageing and oxidation stability</li> <li>– Reduced power loss, lower operating temperature and improved efficiency owing to optimum friction behaviour of the synthetic base oil</li> <li>– Suitable for use at both high and low temperatures</li> <li>– Higher load-carrying capacity of the oil film at operating temperatures above 40 °C (104 °F) due to better viscosity-temperature behaviour</li> <li>– Sufficient protection against fretting damage of gears, also under high peak loads due to high scuffing load capacity</li> </ul> <p>Viscosity is to be selected according to the application.</p>   |
| Klübersynth GEM 4-100 N /150 N /220 N/320 N | <p>Synthetic high-performance and multipurpose oils offering the following advantages over mineral oil of the same viscosity:</p> <ul style="list-style-type: none"> <li>– Significantly longer oil lifetime due to excellent ageing and oxidation stability</li> <li>– Lower operating temperature and improved efficiency due to a reduction of power losses through the optimum friction behaviour of the synthetic base oil</li> <li>– For use at both high and low temperatures</li> <li>– Better load-carrying capacity of the oil film at operating temperatures above 40 °C (104 °F) due to better viscosity-temperature behaviour</li> <li>– Better wear protection, also in rolling bearings</li> <li>– High scuffing load capacity to sufficiently protect gears against seizure, also at high peak loads</li> <li>– Good protection against premature component failure of gears with high micro pitting risk due to high micro pitting resistance</li> </ul> <p>Klübersynth GEM 4 N oils have been approved by ABB Marine for slewing bearings, plain thrust bearings and propeller shaft bearings at the ABB Azipod</p> <p>Viscosity is to be selected according to the application.</p> |
| LAMORA HLP 32 /46 /68                       | <p>Hydraulic oil, complying with DIN 51524, part 2.</p>  |
| MICROLUBE GL 262                            | <p>Special lubricating grease with optimum lubricating effect under boundary friction.</p> <p>Increases bearing lifetime due to its special composition of active ingredients, particularly suitable for vibrations and micro-movement.</p> <p>Approved by ABB Marine for Compact Azipod slewing bearings and propeller shaft bearings.</p>  |
| STABURAGS NBU 30                            | <p>Lubricating grease with high resistance against media. Good sealing effect due to its good water resistance. Approved by ABB Marine for Azipod slewing bearing seals.</p>   |
| STRUCTOVIS BHD 75 S                         | <p>Adhesive lubricant with good wear and corrosion protection and hydrocapillary effect (displaces water from the friction point), especially for chains subject to moisture.</p> <p>The lubricant contains a solvent for better penetration of the lubricant into the chain links.</p>  |
| STRUCTOVIS BHD MF                           | <p>Adhesive lubricant with good wear and corrosion protection for increased component lifetime.</p> <p>The product can be used for curved gear couplings and drive chains subject to moisture. High operational reliability is ensured by solid lubricants with emergency lubricating properties.</p>  |

<sup>1)</sup> Consistency grade according to DIN 51818

<sup>2)</sup> Base oil viscosity at 40 °C (104 °F) according to DIN 51562 part 1/ASTM D-445/ASTM D-7042



|  | Chemical composition  | Technical data   |
|--|---|--|
|  | Synthetic hydrocarbon oil<br>Mineral oil<br>Lithium special soap                | <ul style="list-style-type: none"> <li>– Consistency grade<sup>1)</sup>: NLGI 2</li> <li>– Base oil viscosity<sup>2)</sup>: approx. 120 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: –40 to 150 °C (–40 to 302 °F)</li> </ul>  |
|  | Mineral oil<br>Aluminium complex soap   | <ul style="list-style-type: none"> <li>– Consistency grade<sup>1)</sup>: NLGI 0/00</li> <li>– Base oil viscosity<sup>2)</sup>: approx. 680 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: 0 to 140 °C (32 to 284 °F)</li> </ul>  |
|  | Synthetic ester oil   | <ul style="list-style-type: none"> <li>– Base oil viscosity<sup>2)</sup>: approx. 220/320 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: –30 to 130 °C (–22 to 266 °F)</li> <li>– Biodegradability according to CEC-L-33-A-93 test after 21 days &gt; 70% (Klübersynth GEM 2-220)</li> <li>– Biodegradability in the OECD 301 F test after 28 days &gt; 60% (Klübersynth GEM 2-320)</li> </ul> |
|  | Synthetic hydrocarbon oil<br>Synthetic ester oil                                | <ul style="list-style-type: none"> <li>– Base oil viscosity<sup>2)</sup>: approx. 100/150/220/320 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: –40 to 140 °C (–40 to 284 °F)</li> <li>– Complying with the requirements of DIN 51 517-03 (CLP)</li> </ul>  |
|  | Mineral oil   | <ul style="list-style-type: none"> <li>– Base oil viscosity<sup>2)</sup>: approx. 32/46/68 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: –12 to 120 °C (10 to 248 °F)</li> </ul>  |
|  | Mineral oil<br>Lithium complex soap   | <ul style="list-style-type: none"> <li>– Consistency grade<sup>1)</sup>: NLGI 2</li> <li>– Base oil viscosity<sup>2)</sup>: approx. 280 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: –25 to 140 °C (–13 to 284 °F)</li> </ul>  |
|  | Mineral oil<br>Barium complex soap  | <ul style="list-style-type: none"> <li>– Consistency grade<sup>1)</sup>: NLGI 2</li> <li>– Base oil viscosity<sup>2)</sup>: approx. 500 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: –10 to 150 °C (14 to 302 °F)</li> </ul>   |
|  | Mineral oil<br>Synthetic hydrocarbon oil  | <ul style="list-style-type: none"> <li>– Base oil viscosity of the solvent-free lubricant<sup>2)</sup>: approx. 4 750 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: –5 to 120 °C (23 to 248 °F)</li> </ul>  |
|  | Mineral oil<br>Synthetic hydrocarbon oil<br>Solid lubricant (MoS <sub>2</sub> ) | <ul style="list-style-type: none"> <li>– Base oil viscosity<sup>2)</sup>: approx. 4 500-5 000 mm<sup>2</sup>/s</li> <li>– Service temperature range approx.: –5 to 120 °C (23 to 248 °F)</li> </ul>  |



# Lubricant dispensers

Many lubrication points are difficult to access or a special challenge from a health and safety perspective.

To increase safety, reliability and machine availability, Klüber Lubrication supplies high-performance oils and greases in “intelligent packages” for automatic lubrication of your machines and components.





Selected lubricants are available in automatic lubricant dispensers for single-point lubrication. These tried-and-tested electromechanical or electrochemical devices are available with various speciality lubricants.



**Engine room applications:**  
 – fan bearings  
 – electric motor bearings  
 – pump bearings  
**Lubrication system:**  
 Klübermatic FLEX 60 cm³  
 Klübermatic FLEX 125 cm³



**Life raft davit applications:**  
 – rolling bearings  
 – cable pulley  
**Lubrication system:**  
 Klübermatic FLEX 60 cm³

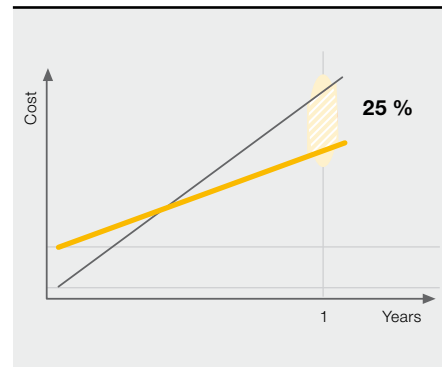
| Klübermatic FLEX  | Klübermatic NOVA  | Klübermatic STAR VARIO  | Klübermatic STAR CONTROL  |
|---|---|---|---|
|  |  |  |  |
| Flexible use – and for lubrication points with high requirements                    | For applications subject to wide temperature fluctuations                           | Precise and adjustable lubricant metering   | Externally controlled single-point relubrication                                      |

# Your benefits

## Economical

- Reduced energy costs as the lubrication point is supplied with the exact amount of fresh lubricant
- Reduction of material costs and man-hours with automatic, accurately metered lubrication
- **Overall cost reduction of up to 25 %**

### Cost reduction with Klübermatic

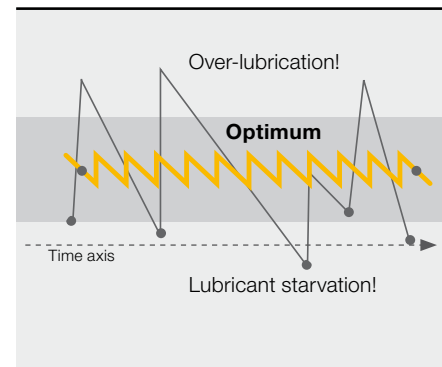


— Manual lubrication  
 — Klübermatic lubrication  
 Calculations per 100 lubrication points

## Safe

- High machine availability through continuous, maintenance-free long-term lubrication
- Minimisation of production failures and predictable maintenance intervals
- **Reduction of accident risks by up to 90 %**, due to fewer visits and simple installation of lubricant dispensers outside risk areas via pipework

### Lubricant release compared

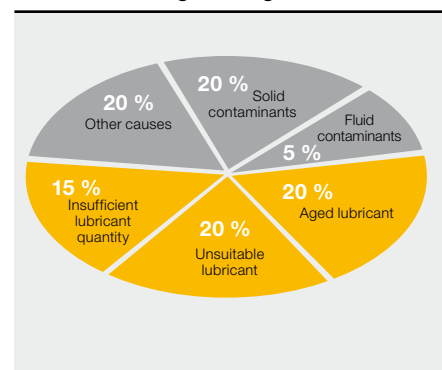


— Manual lubrication  
 — Klübermatic lubrication

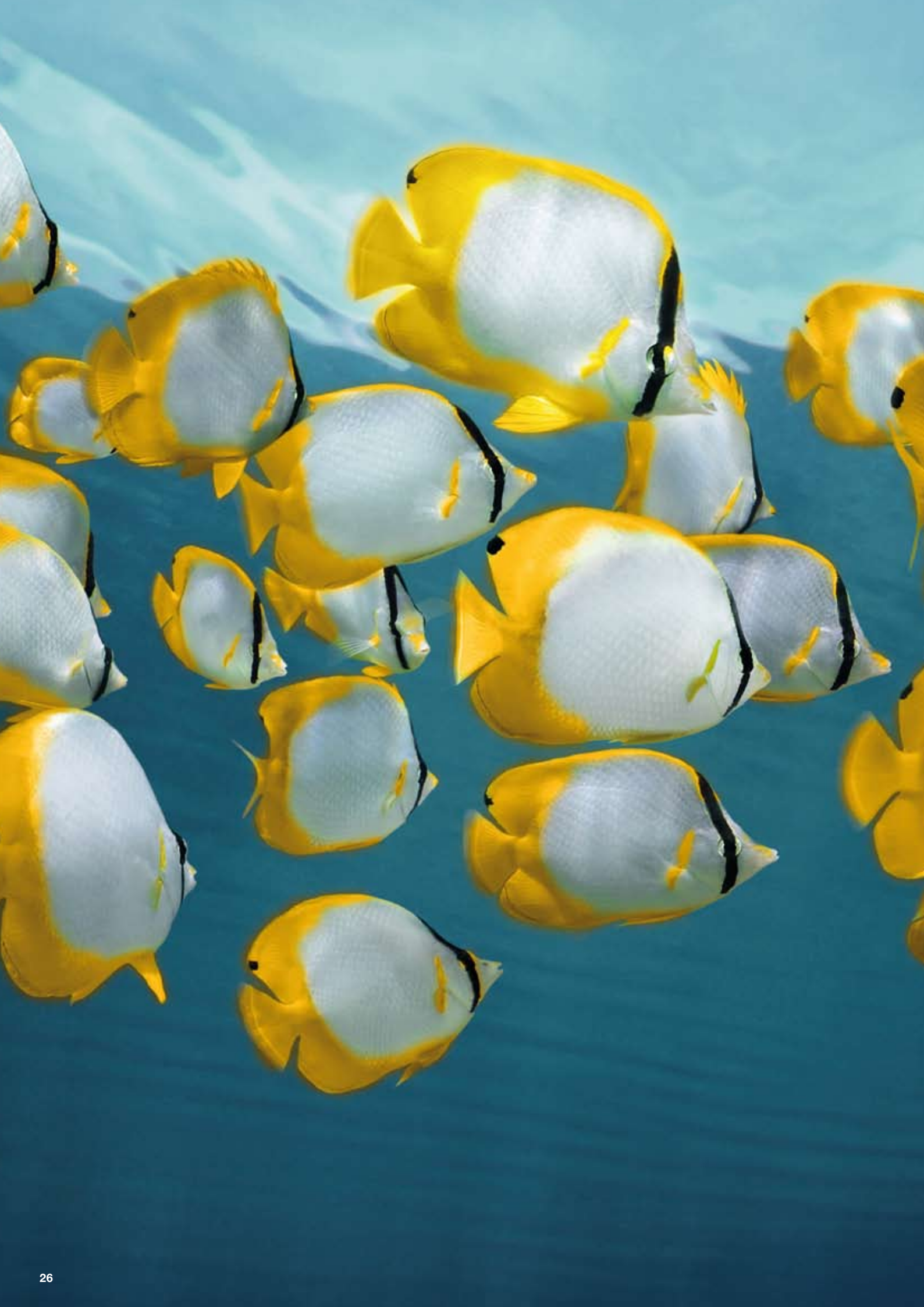
## Reliable

- Clean, reliable and precise lubrication around the clock
- Lubricant starvation or excessive lubrication is prevented
- **Avoid up to 55 % of rolling bearing failures**

### Causes of rolling bearing failure



55 % of rolling bearing failures could be prevented through the use of Klübermatic lubricating systems!





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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.



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