

The ABCs of EALs

Christian Kiefer,
Klüber Lubrication, discusses the
importance of Environmentally
Acceptable Lubricants (EALs).

In the maritime industry, port facilities are crucial to global trade, and lubricants play a key role in maintaining the performance of port equipment. However, many port machines, particularly cranes, still use mineral oils and greases, which have a significant environmental impact. Each STS (ship-to-shore) crane can release up to 500 kg of lubricants into the environment annually due to washing out or dripping. Environmentally sound speciality lubricants offer an efficient and sustainable solution, meeting strict global guidelines while enhancing workers' safety. Suppliers like Klüber Lubrication provide EALs that combine high efficiency with reduced environmental damage. Port operators are increasingly focusing on sustainability to boost productivity and reduce costs, with greener practices potentially providing a competitive edge.

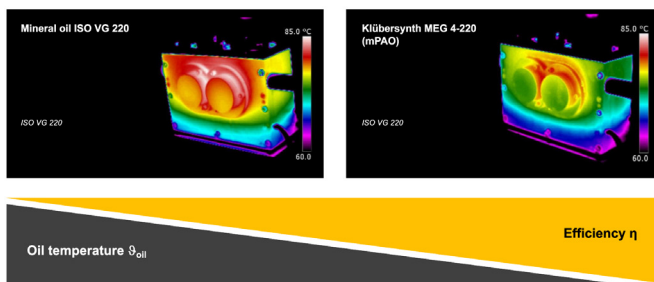
All countries that have signed international treaties such as MARPOL must comply with regulations that address marine pollution from oils and other substances, with lubricants in port facilities being no exception. While there are no uniform global regulations, many countries have developed specific rules for lubricant use in order to protect the environment.

In the United States, the strictest rules apply, with the EPA's Vessel General Permit (VGP) requiring EALs in certain applications like propeller shafts and rudder bearings. Many operators are aware of these strict regulations and adhere to them even when their ships go to other ports, as non-compliance would prevent them from trading with the US. Similar regulations are in place in Canada, as recommended by the Canadian Coast Guard.

The European Union (EU) has various national regulations and EU-wide directives promoting the use of EALs. The EU Water Framework Directive aims to improve water quality and reduce pollution, which indirectly instigates the use of EALs in ports and on ships.

Australia and New Zealand also have national guidelines that encourage the use of EALs in maritime environments, particularly in ports and coastal areas.

In certain Asian countries, strict regulations are enforced. For example, China has rigorous rules for the handling and disposal of lubricants, while Japan's Marine Pollution Prevention Law mandates biodegradable lubricants and stringent port facility regulations. In Singapore, the National Environment Agency promotes environmentally acceptable alternatives, and in India, regulations require measures to prevent oil leaks and ensure proper disposal.



Better energy efficiency and the associated reduced CO₂ footprint have been proven to be achievable by switching to friction-efficient synthetic oils.



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Additionally, voluntary industry initiatives advocate for EALs to reduce the environmental impact of shipping and support more sustainable practices. This overview highlights a growing global awareness in the marine industry of the need to transition from mineral oil-based products to sustainable industry standards.

EALs – small changes, big impact

Lubricating wire ropes and open gears with mineral oil-based lubricants can cause ecological damage, safety risks, and higher maintenance costs. Around 80% of the grease used for cranes either drips off or is washed out, leading to environmental harm, HSE risks like slippery floors, frequent relubrication, high lubricant consumption, and maintenance downtime.

Switching to high-performance EALs can significantly improve these issues with minimal effort. Known for their exceptional performance, EALs from Klüber Lubrication offer resistance to water wash-out, strong adhesion to surfaces, and lower loss rates, resulting in longer relubrication intervals and reduced total cost of ownership (TCO). In addition to their high performance, these EALs meet the most stringent environmental requirements for biodegradability, minimal-toxicity to marine life, and non-bioaccumulation. Designed to naturally break down and minimise harm if released into water, they ensure marine organisms are not adversely affected, making them an ideal choice for maintaining marine ecosystem health, while complying with environmental regulations.

Proven in maritime environments over the past decade, millions of tonnes of EALs are already used in ships and offshore installations. Their successful use in harsh maritime conditions demonstrates their reliability and efficiency, making them a viable choice for port facilities. EALs provide reduced environmental impact, increased safety, and longer intervals between maintenance, thus improving sustainability and operational efficiency in ports.

EALs in port facilities

In port facilities, cranes are constantly in use to lift and move heavy loads, making their flawless performance a crucial requirement. Advanced additives in synthetic lubricants enhance crane efficiency by protecting against corrosion, slowing oxidation, and minimising deposits. These additives ensure lubricant stability under high loads, allowing cranes to operate efficiently under extreme climatic conditions. The use of EALs reduces the environmental impact as it minimises dripping and washing out in open lubrication points like wire ropes, open gears, bearings and couplings. Their superior lubricating properties reduce friction and wear, leading to more efficient crane operation. Additionally, using EALs in open lubrication points can lower HSE risks, as well as reduce overall lubricant consumption.

Carbon neutrality by 2040

When talking about sustainability, the question of energy efficiency and CO₂ neutrality must not be missing. The EU Commission has set the goal of becoming CO₂ neutral by 2040, and the IAPH (International Association of Ports and Harbors) will lead the way in transforming global port operations towards sustainable practices. Better energy efficiency and the associated reduced CO₂ footprint have proven attainable goals in the lubricant world by switching to friction-efficient synthetic oils. For example, 5.1% savings were achieved on conveyor chains in bulk terminals and main hoisting winches in STS cranes also offer the potential for a significant reduction: The energy savings potential for an STS crane is conservatively estimated to be at least 1.5%, translating to about 90 MWh or approximately 36 t of CO₂ reduction per crane annually (in case conventional energy sources are in place). For example, using high-performance mPAO oils like Klübersynth MEG 4 in a main hoist winch gear (with a 3-stage helical gear, 3000 kW nominal load, and 2000 operating hours per year) can improve efficiency by 1.5%. This results in annual energy savings of 90 MWh and electricity cost savings of €24 300 based on an electricity price of €0.27/kWh. The CO₂ emissions savings amount to 36 tpy, according to the German Federal Environmental Agency's 2019 figure of 401 g CO₂/kWh for the German electricity mix. The return on investment (ROI) for switching to high-performance oils is calculated to be less than 4 months.

Proven success of EALs: two real-world examples in action

Case study 1

A tanker shipping company with five modern product tankers faced high grease consumption and maintenance issues due to harsh weather conditions that washed out mineral oil-based greases used in deck applications such as: cranes, steel wire ropes, winches, hatches, and slow-moving plain bearings. This led to increased lubricant use, frequent re-greasing, corrosion, wear, slippery floors, and environmental damage.

Seeking a technically better, environmentally acceptable solution, the company tested Klüberbio AG 39-602 N, an EAL certified with the European Ecolabel, for 12 months under harsh North Sea conditions. The lubricant is known for its excellent adhesion, water washout stability, and corrosion protection.

The use of Klüberbio AG 39-602 N reduced grease consumption by about 50%, lowering environmental impact and HSE risks from slippery floors. Equipment inspections showed an improved condition, leading to lower maintenance costs and total ownership costs. Consequently, Klüberbio AG 39-602 N is now the new standard for deck equipment on the company's tankers.

Case study 2

Multinational offshore company finds sustainable solution for steel wire rope lubrication.

The solution: Klüberbio AM 92-142, developed with wire rope manufacturer Redaelli is an EAL lubricant with excellent adhesion, water resistance, and temperature stability.

The operator sought to reduce the environmental impact of its offshore service vessels. Previously, standard mineral oil greases required up to 12 relubrication intervals per year, leading to significant grease dripping, contamination, and slip hazards on deck. The solution needed to be globally available to ensure consistent supply across all regions.

Klüberbio AM 92-142 was chosen for its sustainability and effectiveness. This biodegradable, non-bioaccumulative EAL lubricant offers enhanced adhesion, water resistance, and temperature stability. Replacing the wire rope grease with Klüberbio AM 92-142 has reduced relubrication intervals to four times p/y, cutting grease consumption and maintenance. This also lessens environmental impact and improves occupational safety by preventing slippery floors. Additionally, the lubricant's corrosion protection extends the wire ropes' service life.

What fears/reservations do operators have?

Operators of ships and port facilities may be reluctant to switch to EALs for a variety of reasons. The decision to use EALs requires careful consideration of costs, benefits and possible risks. Operators must find a balance between financial, functional and operational factors.

Cost

- Higher acquisition costs: EALs are often pricier than conventional lubricants, posing a financial burden, particularly for operators of older or large-scale equipment needing regular refills.
- Long-term savings: Despite higher upfront costs, EALs reduce expenses over time through efficient operation, extended relubrication intervals, and less unplanned downtime. Their superior temperature properties and oxidation stability provide high performance even under extreme conditions, leading to lower energy consumption and operating costs in port facilities. Additionally, synthetic lubricants offer better wear protection, extending component life and reducing energy consumption. Indirect savings can also arise from lower environmental restrictions or potential tax breaks.

Functionality

- Performance and compatibility concerns: Some operators worry that EALs may not match conventional lubricants in performance, lubricity, and efficiency, especially under extreme conditions



Case study 1: Salt Spray test result with Klüberbio AG 39-602 N, after cleaning.



Case study 1: Salt Spray test result with wire rope grease from competitor (mineral oil-based), after cleaning.

or in specialised applications. There are also concerns about EAL compatibility with existing machines and equipment.

- High efficiency and compatibility: EALs often outperform mineral oil-based lubricants, particularly in challenging conditions like extreme temperatures, salty environments, and water exposure. Enhanced with selected additives and high-quality base oils, EALs perform effectively with minimal effort. They maintain their viscosity across a wide temperature range, ensuring cranes operate efficiently in both summer heat and winter cold.

Reliability

- Experience and evidence: There may be a concern that the long-term reliability and durability of EALs may not yet be fully tested or documented, and that they may not offer the same lifespan as conventional products.
- Proven in the field: EALs have been in use in the marine sector for over ten years and, as shown in

the case studies described above, have proven themselves in the various applications. Synthetic lubricants usually have a longer service life than mineral oil-based products. This results in fewer maintenance intervals and less crane downtime. Since the machines need to be shut down and restarted less often, energy losses are minimised, which increases overall efficiency.

Effort and implementation

- Changes in operations: The introduction of new lubricants may require adjustments to maintenance and operating procedures, which could entail additional effort. Switching to EALs may require additional training for personnel to ensure that the new lubricants are used and managed correctly.
- Easy changeover: The tribology expert Klüber Lubrication offers more than just lubricants. Where necessary, Klüber Lubrication's comprehensive services ensure that the changeover is fast, safe and efficient.

Conclusion: what would operators gain from a changeover?

Transitioning to EALs offers port operators significant short-term and long-term benefits, including cost savings, extended equipment life, and enhanced operational efficiency. EALs have proven their performance even under extreme conditions, reducing unplanned downtime and maintenance needs. This transition also positions operators as leaders in sustainable development, giving them a competitive edge and increased visibility in the industry.

Inclusion in the WPSP (World Port Sustainability Program) data base further amplifies these benefits, providing direct and indirect advantages such as networking, learning opportunities, and support in meeting sustainability targets. Additionally, operators may benefit from complying with environmental regulations and from potential financial incentives, making the shift to EALs both a strategic and financially sound decision. **DB**