Improve fleet reliability

with SKF and Lincoln automatic lubrication systems

The Power of Knowledge Engineering

Fleet maintenance can be performed more efficiently and safely with SKF and Lincoln automatic lubrication systems. Providing lubrication solutions for all types of vessels, SKF helps to optimize your marine operations.

SKF and Lincoln have joined forces to provide the world's most complete portfolio of lubrication solutions, from manual lubricators to the most advanced centralized and automatic lubrication systems on the market. Together, we provide a full range of lubrication tools and expert services, from turnkey design and installation to testing and training.

Drawing on more than 200 years of combined friction management experience, we can help you improve machine reliability, reduce maintenance costs, improve productivity, enhance safety and optimize manpower resources.

Two leading brands. One global resource.

Leveraging our combined knowledge of lubrication

Why choose SKF and Lincoln lubrication systems? In a word, experience. We have drawn upon our combined knowledge of lubrication to develop efficient automatic lubrication systems tailored specifically for marine industry requirements.

On the basis of SKF's expertise in bearings, seals, mechatronics, lubrication systems and services, SKF offers complete solutions to reduce the need for maintenance, extend machine service life and reduce energy use and costs.

When it comes to equipping off-shore, merchant and passenger vessels with high-quality components and intelligent system solutions, SKF is the ideal partner.

With the combination of Lincoln and SKF lubrication portfolios and capabilities, you now have one resource for advanced automatic lubrication systems and best-in-class lubrication services. Representing both brands, your local system house distributor maintains a broad lubrication product offering and is prepared to provide installation or service as needed. In addition, local market specialists are available to share expertise and support based on specific applications.

Smooth integration from the very start

Reducing required maintenance and operating costs in the marine industry can be challenging. With more than 70 years of marine experience, SKF can help owners and operators to improve reliability and safety by utilizing advanced technological solutions.

At SKF, service starts as soon as the project does. Our experts work with you to determine the appropriate solution to meet the requirements of your application. Our engineering data can be integrated seamlessly into your design. State-of-the-art analytical tools enable condition and suitability testing of lubricants, allowing you to operate the systems reliably.

SKF and Lincoln – A powerful formula for reliability:

- **Superior product innovation:**
  The broadest and most advanced lubrication offering in the industry
- **Unequalled global support:**
  Two teams of lubrication experts join forces
- **World-class installation support:**
  The combined expertise to install the right solution

To explore our solutions, visit **skf.com/TheFormula**

A complete portfolio of lubrication solutions to improve system reliability

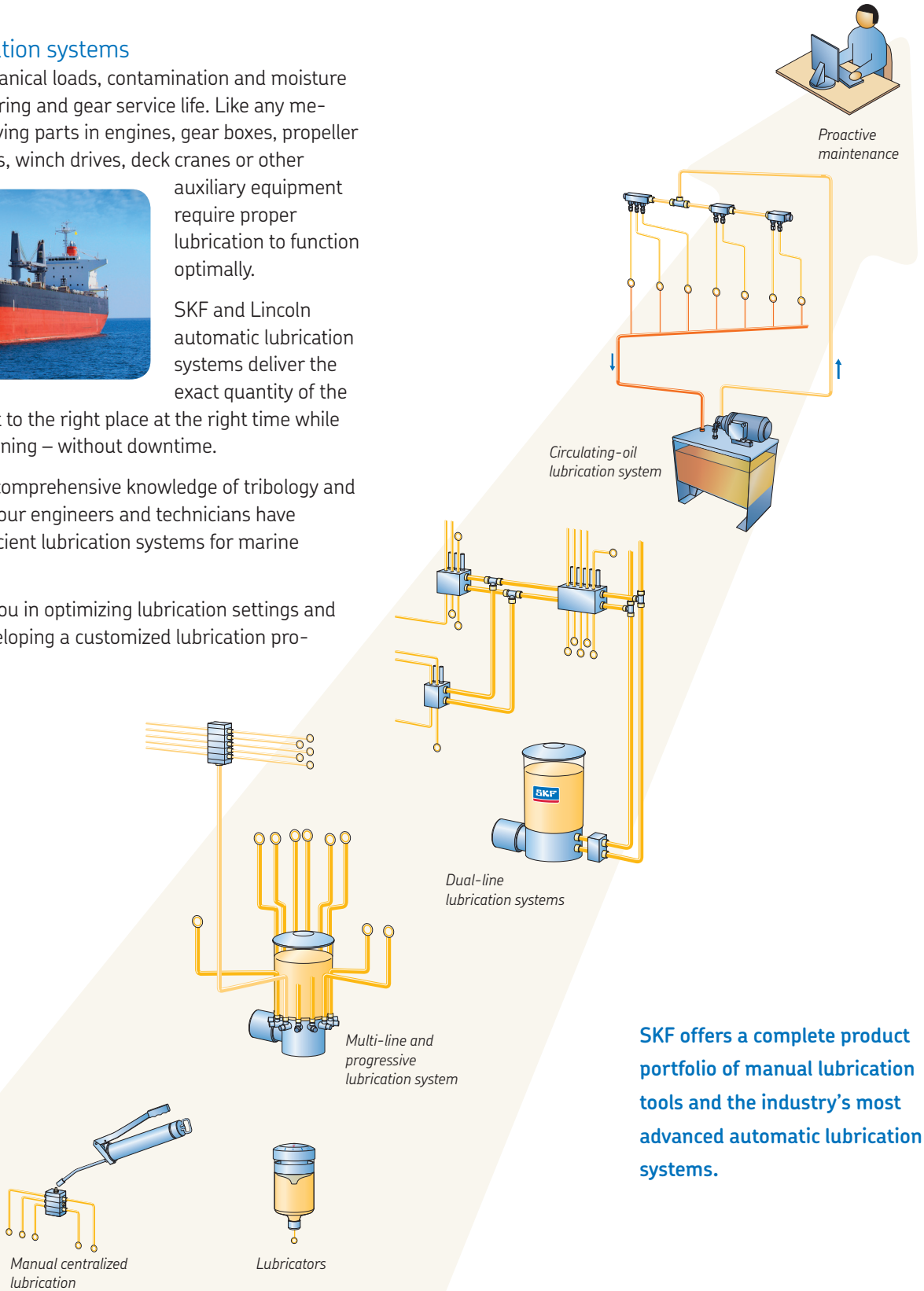
Automatic lubrication systems

Vibration, high mechanical loads, contamination and moisture are all threats to bearing and gear service life. Like any mechanical system, moving parts in engines, gear boxes, propeller shafts, steering gears, winch drives, deck cranes or other auxiliary equipment require proper lubrication to function optimally.

SKF and Lincoln automatic lubrication systems deliver the exact quantity of the appropriate lubricant to the right place at the right time while the equipment is running – without downtime.

Drawing upon their comprehensive knowledge of tribology and industrial demands, our engineers and technicians have developed highly efficient lubrication systems for marine applications.

SKF also can assist you in optimizing lubrication settings and intervals, and in developing a customized lubrication programme.



SKF offers a complete product portfolio of manual lubrication tools and the industry's most advanced automatic lubrication systems.

Simplify maintenance tasks and reduce operating costs

Efficiency and safety are key in the marine industry. Ship operators need to maximize productivity, reduce maintenance costs and provide a safe working environment for the crew while at sea.

Automatic lubrication reduces downtime, so your equipment is available when you need it. In addition to helping increase reliability and availability, lubrication systems help to extend service life, reduce operational and lubricant costs and minimize environmental impact by avoiding over-lubrication. Also, reducing manual lubrication results in fewer potential accidents, and crew members can be utilized for other tasks.

Maximize availability

Precise automatic lubrication provides a significant benefit for operators. Reliably delivering lubricant from a central source to all of the connected friction points, SKF and Lincoln automatic lubrication systems help prevent bearing damage and un-scheduled machine downtime, while optimizing manpower resources.

Maintenance benefits

- **Minimizes labor required for lubrication**
- **Extends repair intervals**
- **Reduces consumable costs**
- **Reduces wear and corrosion**

Operational benefits

- **Helps to ensure that equipment is properly lubricated**
- **Eliminates over- and under-lubrication**
- **Increases reliability**
- **Improves profitability**

Safety benefits

- **Eliminates manual lubrication of difficult-to-access points or in explosion-protected areas**
- **Reduces risk of slips and falls when compared to manual lubrication**
- **Fewer accidents**

Reduce operating costs

Utilizing high-quality SKF and Lincoln automatic lubrication systems pays off in many ways.

When a system is installed, it will function virtually maintenance free, reducing total cost of operation.

Automatic lubrication can reduce lubricant consumption significantly and is much cleaner than manual lubrication, resulting in less lubricant to affect the environment. For example, SKF's cylinder lubrication systems for diesel engines can lower lubricant consumption by up to 30 percent.

All of this means reduced operating costs and, ultimately, improved fleet profitability.

Solutions for challenging applications

SKF lubrication products are available for any type of vessel. In fact, many lubrication applications on a ship can be completed more efficiently and safely with SKF and Lincoln lubrication systems.

SKF's offering includes lubrication solutions for:

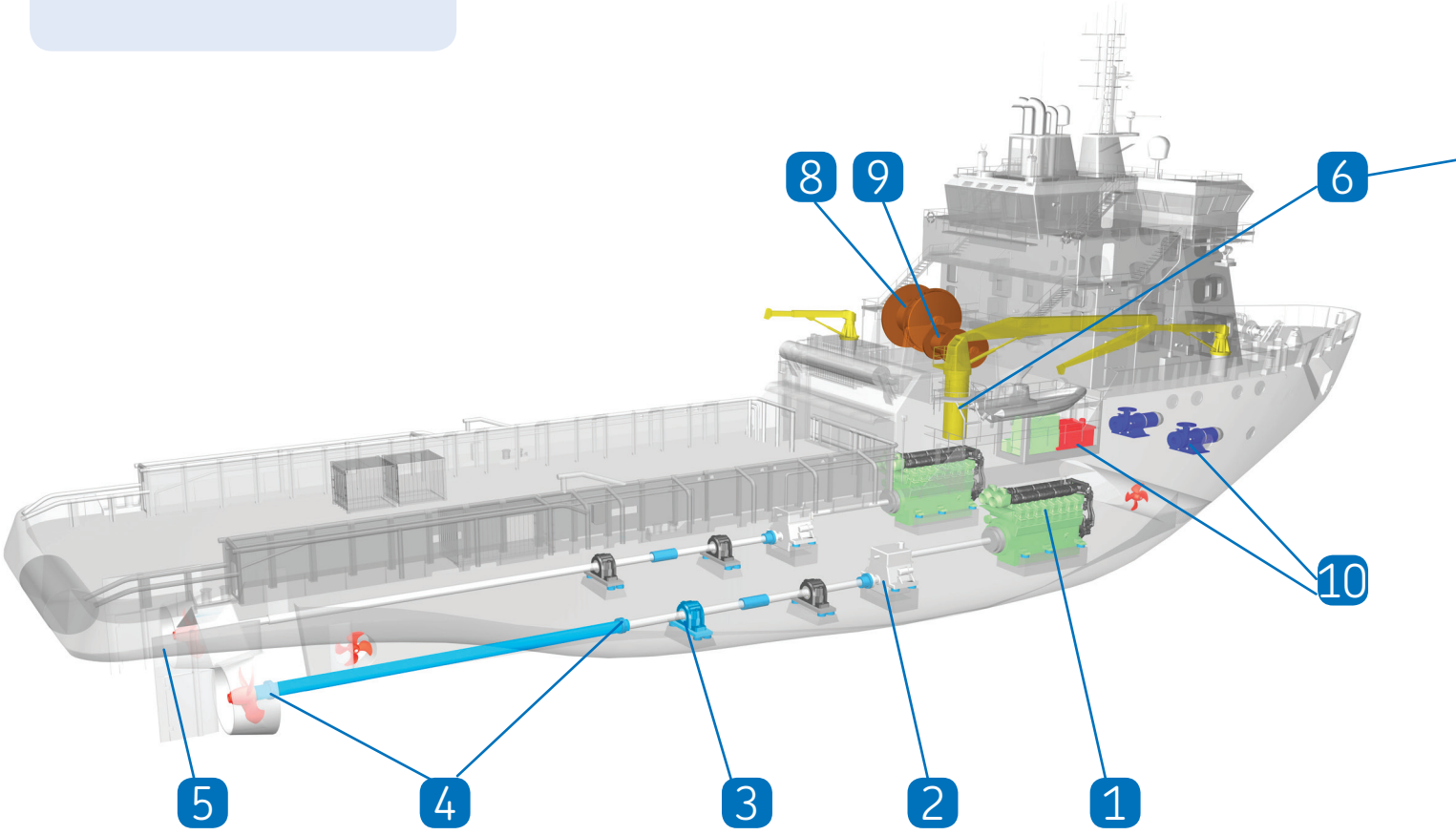
1. Engines
2. Gear boxes
3. Propeller shaft bearings
4. Stern tube seals
5. Steering gears
6. Deck cranes
7. Jacking systems
8. Winch drives
9. Ropes and cables
10. Additional equipment

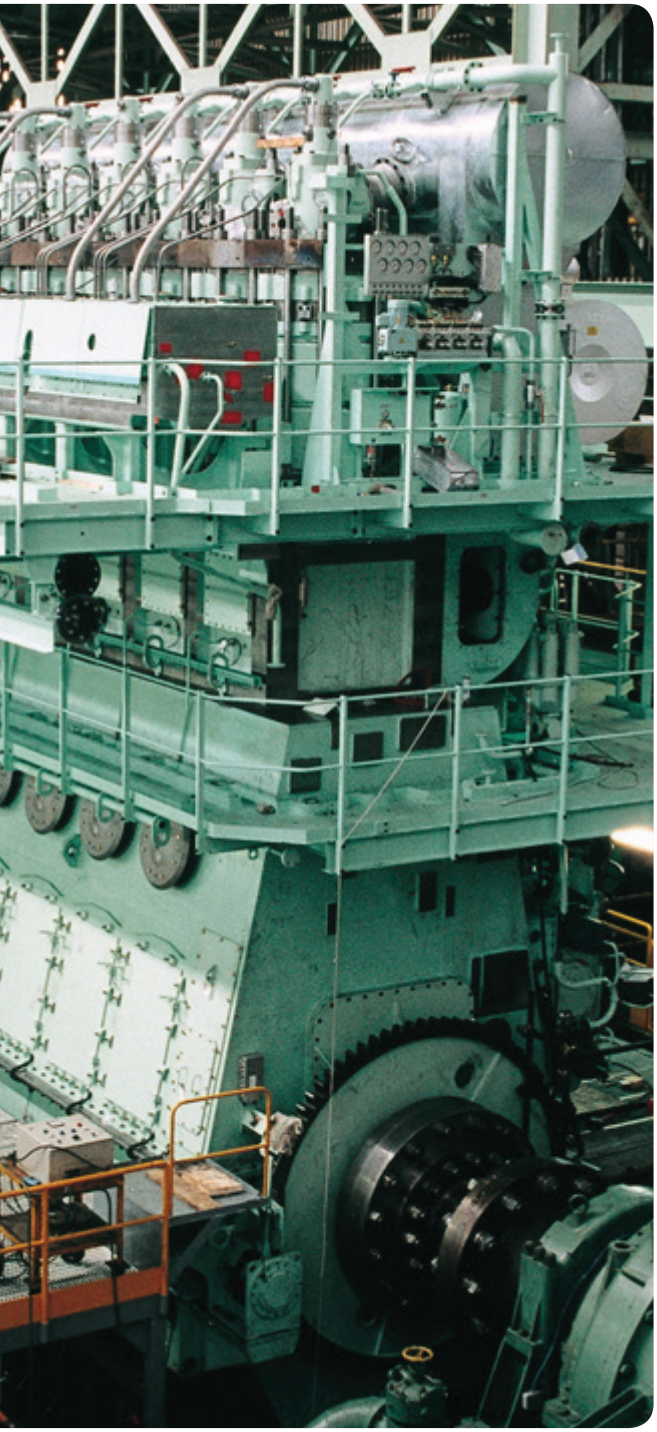
SKF provides product solutions for the proper lubrication of propeller shaft bearings and steering gears, as well as winch drives, ropes and cables. In addition, grease and oil spraying systems are available for jacking systems and open gears.

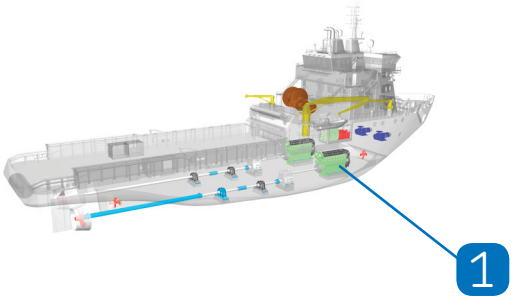
Oil is the lubricant of choice for heavy-loaded bearings in gear boxes or stern tube seals. It lubricates and cools the lubrication points and removes contaminants from the oil cycle.

SKF also offers efficient lubrication solutions for diesel engines that help to reduce cylinder lubricant consumption.

Class-approved and ATEX- or ICE-certified products for all applications are available upon request.







Cylinder lubrication systems for diesel engines

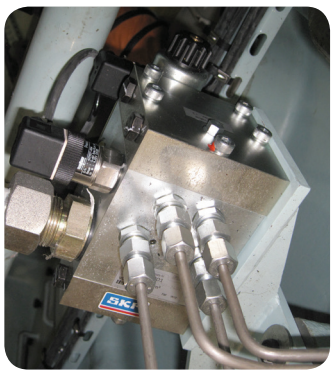
For large, four-stroke engines with bore diameters ranging from 250–640 mm (*9–25 in*), inlet valve seat lubrication is preferred to reduce valve seat wear, and additional cylinder lubrication might be an option. Use of SKF lubrication products can extend the life of the cylinder liner and piston and increase the time between required service.

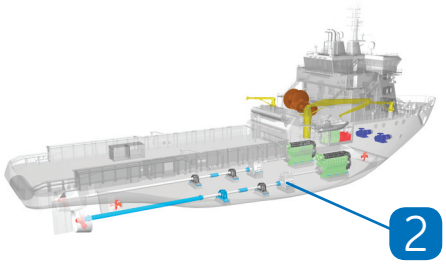
Used on container vessels, oil and gas tankers and bulk carriers, large, two-stroke crosshead diesel engines with bore diameters from 300–960 mm (*11–38 in*) require significant amounts of lubricating oil. This results in high operating costs and emissions.

To meet this challenge, SKF offers electronically controlled SKF CLU4 and CLU5 cylinder lubrication systems. These units provide a load-dependent lubricating oil feed rate to the cylinder piston, independent of temperature and viscosity changes.

Benefits include:

- **Reduces cylinder lubrication oil consumption by up to 30 percent**
- **Minimizes CO_2 and solid particle emissions**
- **Enables lubrication system servicing while engine is running**
- **Meets highest fire safety standards**





Example of savings provided by SKF cylinder lubrication system:

When travelling between continents, a large container ship is powered by an engine with a maximum rating of 65 600 kW (*89 000 BHP*) and an operation time of 6 000 hours per year. The ship consumes a total of 360 800 liters (*95 300 gal*) of lubricating oil per year [1)].

By using SKF's electronically timed CLU4 system, a saving of approximately 30 percent, or 108 240 liters (*28 600 gal*) of lubricant can be achieved [2)]. This lubricant oil savings reduces the ship's operating costs by more than 220 000 USD[3)] per year, enabling the system to pay for itself in the first year of operation.

1 Oil feed rate of 1,1 g/kWh *(0,82 g/BHPh)* at a lube oil density of 0,9 engine load factor of only 75 percent
2 Oil feed rate of 0,77 g/kWh (*0,57 g/BHPh*)
3 Based on a lubricant oil cost of 2,10 USD per liter (*8 USD per gallon*)

SKF's cylinder lubrication system supports latest engine building trends with further fine-tuned technology, which means lower oil feed rate and higher cost savings.

This offer is part of the SKF BeyondZero portfolio of products, services and solutions designed to help our customers reduce environmental impact.
To learn more, visit **skf.com/beyondzero**.

Gear box lubrication systems

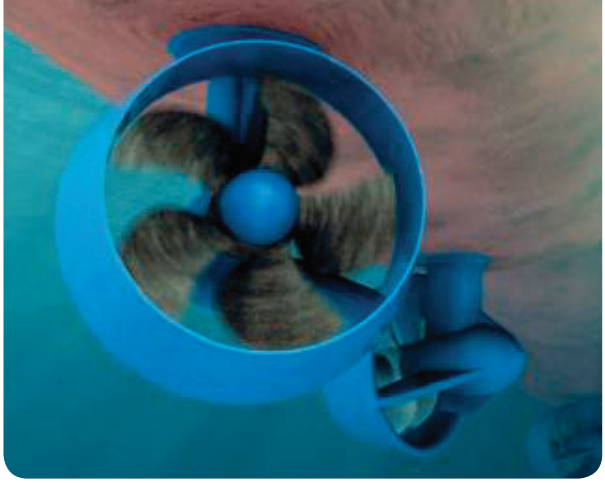
Heavily loaded bearings and gear boxes require special attention. The solution is a circulating oil lubrication system that controls the gear box temperature, separates dirt particles, air bubbles or foam and water from the oil. A pressurized oil system transports the lubricant to the individually adjustable flow meters.

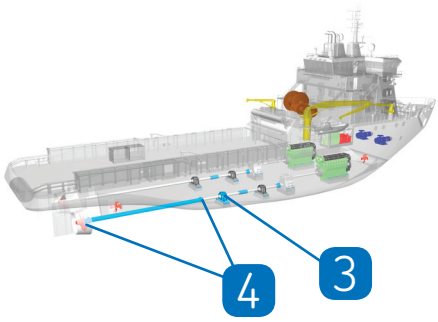
These customer-specific solutions consist of compact units in a pump-cooler arrangement that supply the lubrication points with the right amount of tempered lubricating oil. Durable materials help ensure that even extreme ambient conditions have no negative effect on the system's functionality.

Actual delivery rates can be monitored visually or electronically, and multiple warning levels are available for condition-based maintenance. SKF CircOil systems are offered in a wide range of tailored and ready-to-use solutions for volumetric flows.

The number and type of units are determined by the lubricant used and its viscosity index, the required volume and the required pressure. Gear, gerotor and screw pumps often are used with these systems.

SKF circulating oil lubrication systems can be used in explosive atmospheres, up to ATEX zone 1, or in compliance with relevant standards such as the American Petroleum Institute's (API) Standard 614.





Propeller shaft and thruster lubrication

Propeller shafts and thrusters are vital elements with a high mechanical stress factor. The application, power rating and design determine whether grease or oil circulating systems are required.

SKF CircOil lubrication is preferred for high-torque requirements involving heat removal. Conditioned oil is fed from the oil supply system to the bearings by ordinary throttles or flow limiter systems, which are pressure and viscosity compensated.

SKF Multi-line grease lubricators, often in combination with progressive feeders, are designed to handle the stiff greases even during harsh winter conditions.

Stern tube seal lubrication

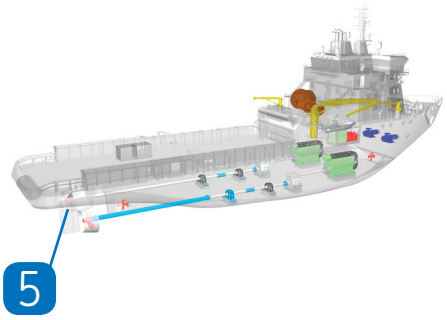
This important seal keeps sea water out of the ship and protects the propeller shaft bearing from premature failures. Stern tube seal lubrication protects the seal arrangement and helps to avoid leakage.

Precise oil metering and monitoring systems provide the optimum sealing pressure using clean oil. A simple and reliable positive displacement pump, such as SKF series RA, are suitable for small continuous flow rates of one liter (*0,26 gal*) per day.

Approvals of the classification societies are available upon request.

Environmental aspects, such as the revised Vessel General Permit (VGP) issued by the U.S. Environmental Protection Agency (EPA), must be considered. The VGP makes it mandatory to use Environmentally Acceptable Lubricants (EALs) in systems such as stern tubes, thrusters, pod drives, controllable pitch propellers, stabilizers and mechanical equipment.

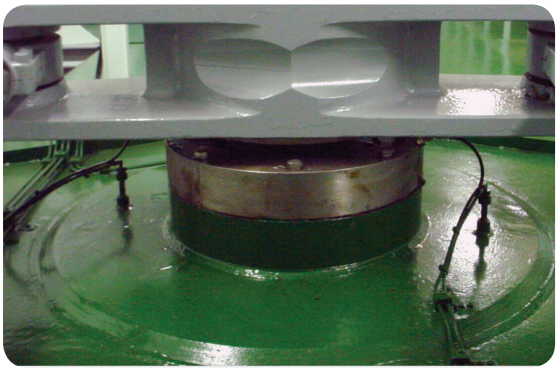
SKF lubrication systems can handle and condition lubricants that meet these environmental requirements.

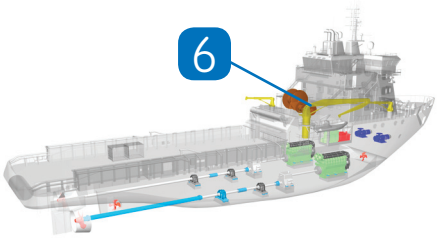


Steering gear lubrication

Steering gears and rudder shocks are exposed to vibration and high mechanical loads and must be lubricated properly.

Multi-line grease lubrication systems provide a pre-defined amount of lubricant in order to avoid over- and under lubrication. These reliable systems utilize pumps with up to 30 lubricant outlets and can be connected directly to the lubrication points. When used in combination with progressive metering devices, a multi-line system can be monitored easily. Featuring impeller technology, the system's pumps can handle heavy grease up to NLGI Grade 2 at freezing temperatures.





Minimize the risk of accidents

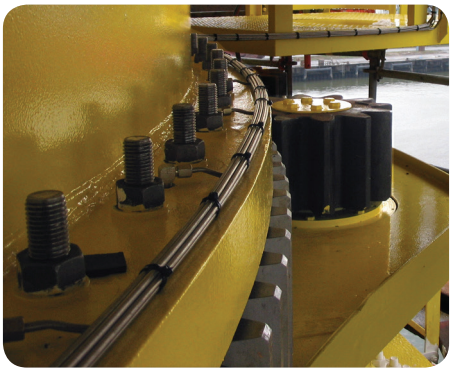
Slewing bearings for deck cranes are large in diameter. The loads are very high, and they operate under extreme conditions. To avoid excess wear and corrosion, and to make sure the crane is ready to work, these bearings must be lubricated frequently. Doing this manually takes up to half an hour each time and can create serious safety issues.

Automatic lubrication systems provide a consistent supply of grease to these difficult-to-reach lubrication points. Maintenance technicians no longer need to climb to each lubrication point, thereby increasing safety. Also automatic lubrication systems help to reduce corrosion, wear and down time.

SKF offers a wide range of lubrication solutions for off-shore cranes. These automated lubrication systems deliver pre-defined amounts of lubricant to avoid over- and under-lubrication and help to ensure that the equipment is ready to use.

For sizeable applications, a dual-line lubrication system can supply numerous lubrication points from a single pump unit source. In addition, the parallel setup allows for a simple system design.

Lubrication pinions also help to ensure that the gear slewing remains optimally lubricated during operation. Sophisticated technology distributes the lubricant evenly on the entire tooth flank.



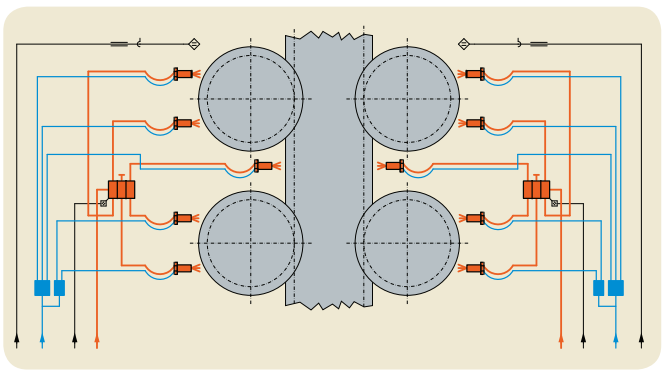
Lubricating tooth by tooth

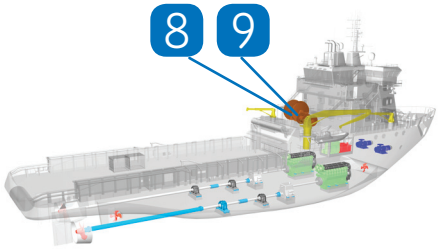
Jacking systems on off-shore industry vessels work under extreme environmental conditions, so proper lubrication with the right lubricant is essential to reduce drive pinion and tooth flange wear.

The jacking process can take several hours. During this procedure, the system must be lubricated tooth by tooth. Using an automatic lubrication system can save a significant amount of time each day and improve worker safety.

Options include connecting the pinions directly to an automatic lubrication system or using a multi-line / progressive system to feed lubricant to a lubricating pinion. SKF's offering includes electric, hydraulic and air-operated pump units.

In addition, SKF offers a grease spraying system to lubricate the gear rack of a jacking system. The system features a stainless steel design that withstands harsh environments. The electrically, hydraulically or pneumatically driven spray nozzles provide an adjustable spray pattern up to 150 mm (6 *in*). Electrically monitored nozzles are available upon request.





Winch drives

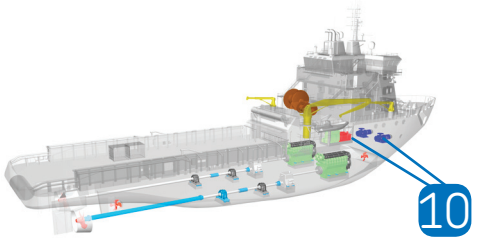
Automatic lubrication systems deliver a consistent supply of grease to winch drive lubrication points while the winch is operating. Also, an automatic lubrication system helps to reduce corrosion, wear and unplanned downtime.

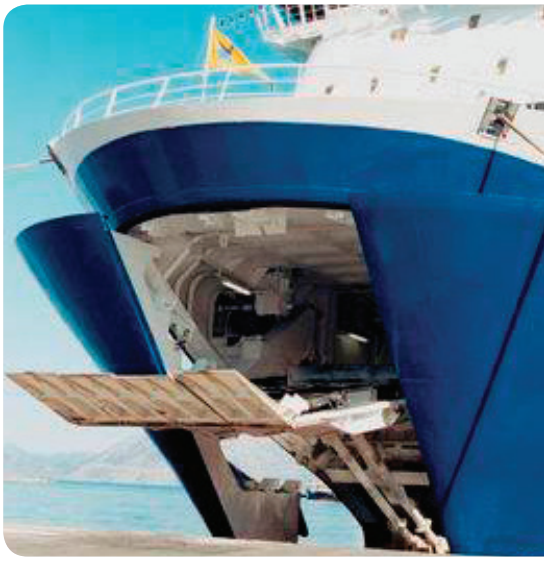
Multi-line pumps, in combination with progressive metering devices, can be connected directly to the lubrication points. In addition, SKF offers explosion-approved solutions as part of our product portfolio.

Ropes and cables

Additional options are available to lubricate ropes and cables. Spraying systems for open gears and cables are designed for oil and grease. They can be driven with a multi-line pump, which feeds the lubricant to the spraying nozzles. These nozzles deliver a consistent lubricant film to the component's surface. Because oil can penetrate the ropes, it helps to minimize corrosion as well as wear.

Wire rope lubricators clasp the rope and penetrate it directly with grease. Also, air-operated barrel pumps are available to handle special rope lubricant with high MoS2 or graphite content.





Additional marine equipment applications

Other applications on vessels that would benefit from automatic lubrication systems include:

- **Genset bearings**
- **Stabilizers**
- **Folding gates on Ro-Ro-ferries**
- **Fire-fighting equipment**

Wherever moving components are exposed to harsh conditions, automatic lubrication systems can help to minimize wear and corrosion, reduce manpower hours and keep your fleet on the water.

Comprehensive range of lubrication components

No matter which lubrication system best suits the application, SKF offers a comprehensive range of quality lubrication pumps, metering devices, control and monitoring units and all necessary accessories. Individual components are coated for protection against corrosion (corrosion class C5 M) and combined with stainless steel components for long life. Also, explosion-approved and class-certified components are available upon request.

Lubrication pumps

SKF's portfolio ranges from single-point, automatic lubricators and pump units with integrated grease reservoirs for single-, dual- or multi-line and progressive lubrication systems to tailored solutions for circulating oil systems.

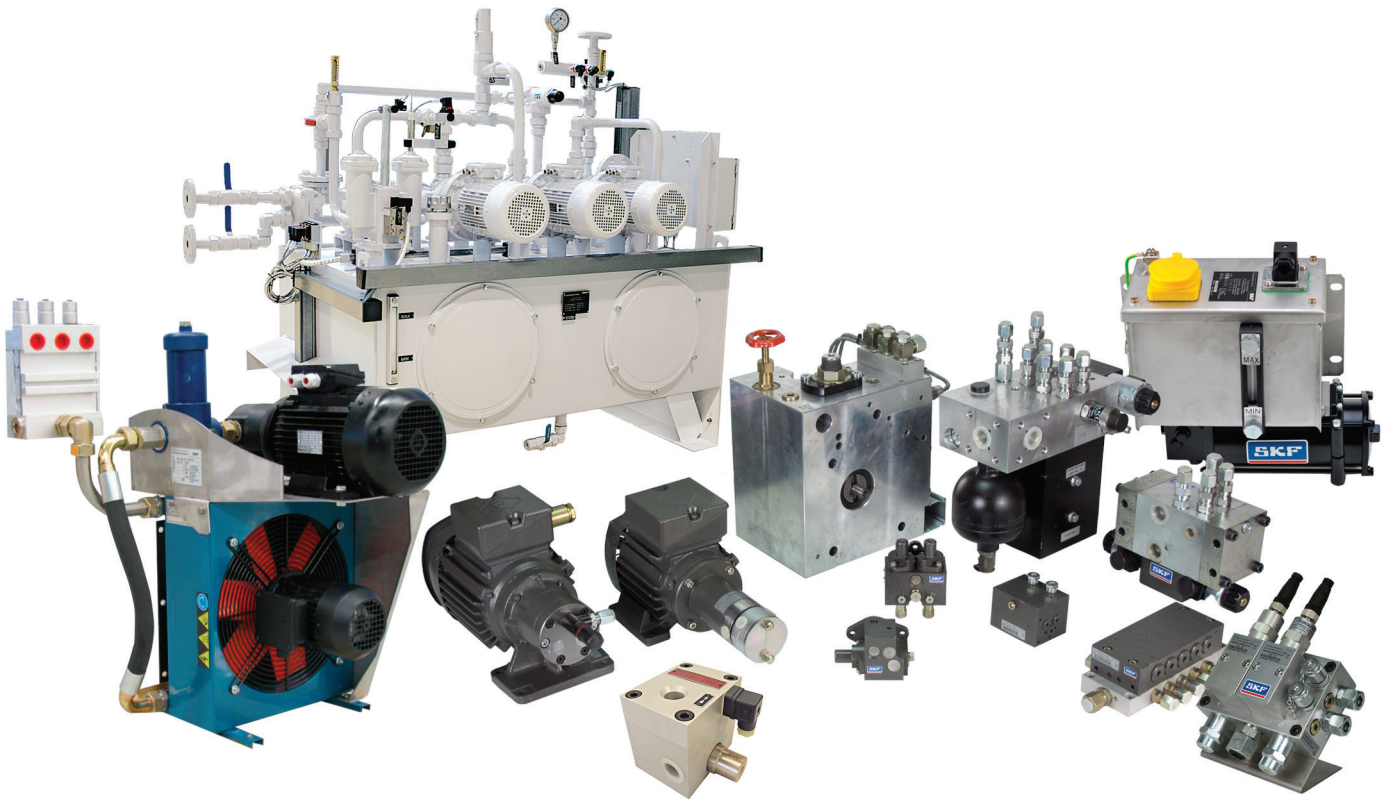
SKF offers mechanically, electrically, hydraulically and pneumatically driven pumps. All pump housings are weather-resistant, and saltwater-resistant versions are available. In addition, the pumps are suitable for oil and standard greases up to and including NLGI Grade 3, as well as for use in low working temperatures.

Criteria, such as ambient conditions, required delivery rates, lubricants employed and service intervals, determine which lubrication pump should be selected. Pumps are available with various control and monitoring options.

Lubricant metering devices

Different lubrication systems require different metering devices. All SKF and Lincoln lubricant metering devices are high-precision components, available in special materials for various climates. Several designs are suitable for high-pressure applications, and system operation can be verified easily through electronic or visual monitoring.

SKF's offering is completed by additional system components such as spraying nozzles or lubricating pinions for open gear lubrication.



Monitoring

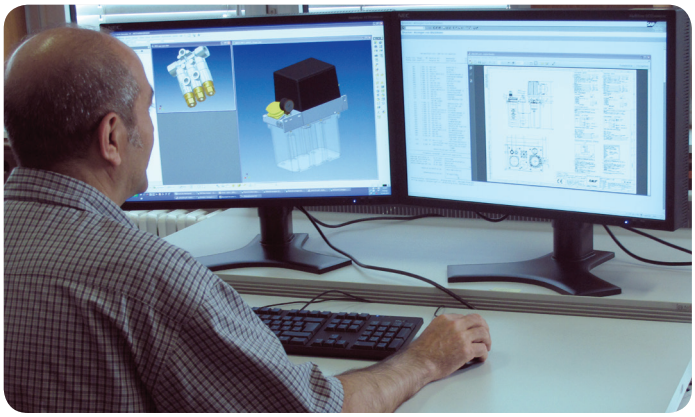
Monitoring and control are essential to the efficient operation of lubrication systems. Installed in conjunction with intelligent monitoring devices, automatic lubrication systems can facilitate economical and optimal lubrication.

With the instruments we provide, you have access to all values important for controlling your system – temperature, pressure, volumetric flow and fill level – whether visually or with digital or analog signal, time or load-dependent settings.

SKF has developed many of our products specifically for use in potentially explosive atmospheres. We meet numerous requirements, including the European Union Directive 94/9/EC. To comply with this so-called "ATEX" Directive, we follow both the requirements for electrical and non-electrical equipment according to the related EN standards. Furthermore, we can provide some products in which all electrical parts have IECEx certification.

Most products are available for explosion group IIC/IIIC (flammable vapors and gases) and equipment protection level (EPL) Gb/Db (see IEC / EN 60079-0).

Service solutions from SKF



Design in 3-D and electronic CAD product catalog

3-D CAD data is available in native format in the online product catalog, which is based on the eCATALOGsolutions technology by CADENAS GmbH. You can configure your products online from the centralized lubrication area and integrate them into your design process free of charge. You can integrate the CAD data seamlessly into your layout plans. The SKF LubCAD app allows you to use the SKF CAD download portal for lubrication systems with its full functionality for your mobile devices.

Access our online catalogue at
http://skf-lubrication.partcommunity.com

Retrofitting centralized lubrication systems

Maintenance and repair costs during system downtime quickly can become unwieldy. That is why we offer on-site professional retrofitting of centralized lubrication systems at your location. We also can provide maintenance and repair services during ongoing operations.

In addition, our portfolio includes other solutions that can simplify maintenance for you, from an electric refilling pump that has been optimized for the conditions on a ship to appropriate fittings and accessories.

Procurement logistics and synchronized production

We can tailor our logistics processes to the requirements of our customers. For example, using synchronized electronic KANBAN systems with first-in, first-out logistics, we enable an inventory-free supply for manufacturing and assembly that is synchronized with production.

As a result, run-through times and total outlays are improved, and the risk of loss and damage is reduced. This results in optimum supply chain management, whether your needs are exclusively local or global.

Global experience, global support

More than 200 years of combined SKF and Lincoln experience

SKF has been involved in the marine industry for decades. By uniting the worldwide experience, portfolios and distribution networks of the SKF and Lincoln brands, we offer the industry's most complete range of lubrication management solutions available in every major port across the globe.

Whatever the size or design of your vessel, SKF has the products and resources to help you increase bearing life, machine uptime and safety, while minimizing manpower hours, maintenance costs and environmental impact.

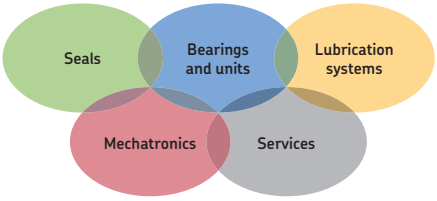
A network of experienced partners

SKF- and Lincoln-branded products, systems and services are available through a global network of distributor partners, supported by one unified sales organization committed to your success. Systems house distributors around the world offer turnkey solutions and extensive aftermarket support. In addition to maintaining a local inventory of system components and spare parts, these factory-trained lubrication specialists can provide:

- **Customized lubrication system design**
- **System installation and start up**
- **Service and repair**
- **Lubrication analysis and testing**
- **Lubrication management training**
- **Warranty support**
- **System maintenance contracts**
- **Vessel surveys and recommendations**
- **Return-on-investment (ROI) analysis**
- **Guidance on safety and environmental issues**
- **Pre-assembled lubrication kits for easy retrofitting**

Here for you, wherever you are

With lubrication application centres located on every continent and a worldwide distributor network, SKF has the people, products and support you need to optimize your lubrication management programme. For more information, contact your SKF representative or visit **skf.com/TheFormula**.



The Power of Knowledge Engineering
Combining products, people, and application-specific knowledge, SKF delivers innovative solutions to equipment manufacturers and production facilities in every major industry worldwide. Having expertise in multiple competence areas supports SKF Life Cycle Management, a proven approach to improving equipment reliability, optimizing operational and energy efficiency and reducing total cost of ownership.

These competence areas include bearings and units, seals, lubrication systems, mechatronics, and a wide range of services, from 3-D computer modelling to cloud-based condition monitoring and asset management services.

SKF's global footprint provides SKF customers with uniform quality standards and worldwide product availability. Our local presence provides direct access to the experience, knowledge and ingenuity of SKF people.

SKF BeyondZero is more than our climate strategy for a sustainable environment: it is our mantra; a way of thinking, innovating and acting.

For us, SKF BeyondZero means that we will reduce the negative environmental impact from our own operations and at the same time, increase the positive environmental contribution by offering our customers the SKF BeyondZero portfolio of products and services with enhanced environmental performance characteristics.

For inclusion in the SKF BeyondZero portfolio, a product, service or solution must deliver significant environmental benefits without serious environmental trade-offs.

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