LINCOLN

SKF

Improving performance and reliability

with SKF and Lincoln automatic lubrication systems for the oil and gas industry

The Power of Knowledge Engineering

Oil and gas exploration, drilling and production processes around the world operate more reliably and efficiently because of SKF and Lincoln automatic lubrication systems. Whether on land or water, in the desert or at the Arctic Circle, SKF has the right lubrication solution for critical components.

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 the requirements of the oil and gas industry.

Utilizing our expertise in bearings, seals, mechatronics, lubrication systems and services, SKF offers complete solutions to increase productivity, reduce unplanned downtime and extend machine service life, as well as minimize energy use and costs.

When it comes to equipping exploration and production platforms, ships or refineries 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 go-to resource for best-in-class lubrication services and advanced automatic lubrication systems. Representing both brands, your local 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

Meeting the lubrication challenges of the oil and gas industry is no small task. However, with more than 50 years of industry experience, SKF offers advanced technological solutions for every stage.

At SKF, service begins as soon as the project does. Our engineering data can be integrated seamlessly into your documentation. 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

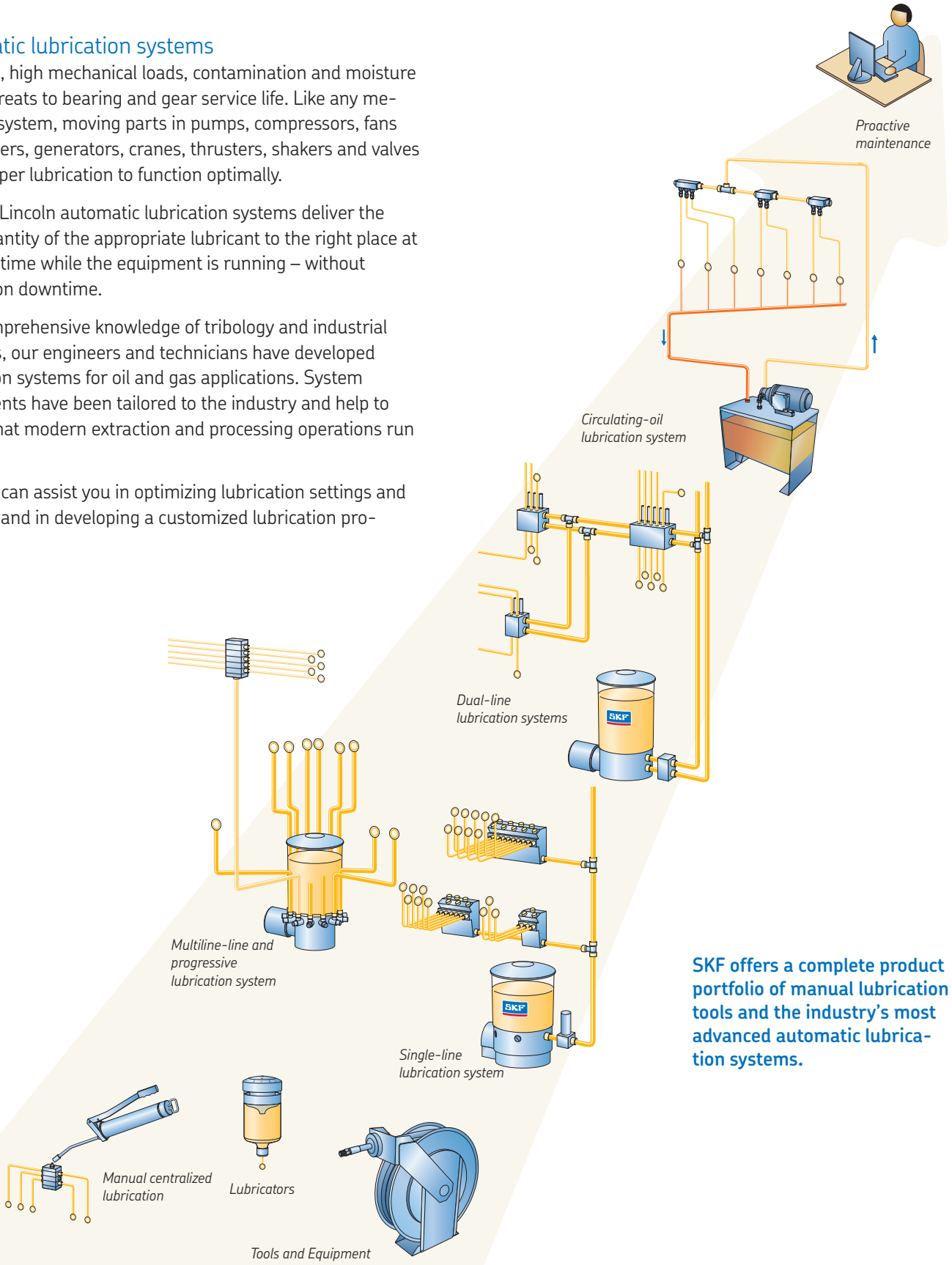
Automatic lubrication systems

Vibration, high mechanical loads, contamination and moisture are all threats to bearing and gear service life. Like any mechanical system, moving parts in pumps, compressors, fans and blowers, generators, cranes, thrusters, shakers and valves need 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 production downtime.

With comprehensive knowledge of tribology and industrial demands, our engineers and technicians have developed lubrication systems for oil and gas applications. System components have been tailored to the industry and help to ensure that modern extraction and processing operations run properly.

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.

Maximize machinery and equipment dependability, minimize maintenance tasks and costs

Because oil and gas is one of the most demanding and challenging industries today, efficiency and safety are key. Automatic lubrication systems can help you improve both.

Equipment and machines run longer with fewer interruptions and require fewer manual touches, reducing the possibility of accidents.

In addition to helping increase reliability and availability, the systems help to extend service life, reduce operational and lubricant costs and minimize environmental impact by avoiding over-lubrication.

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 unscheduled equipment downtime, while optimizing manpower resources.

Reduce operating costs

Utilizing high-quality SKF and Lincoln automatic lubrication systems pays off in many ways. When a system is installed, the lubricated equipment will operate virtually maintenance free, reducing total cost of production and operation. Automatic lubrication can reduce lubricant consumption significantly and is much cleaner than manual lubrication, resulting in less lubricant to affect the environment.

Maintenance benefits

- **Reduces labour costs**
- **Extends repair intervals**
- **Eliminates over- and under-lubrication**

Operational benefits

- **Increases reliability**
- **Reduces unplanned downtime**
- **Improves profitability**

Safety benefits

- **Increases worker safety by eliminating manual lubrication of difficult-to-access points**
- **Reduces risk of slips and falls when compared to manual lubrication**
- **Fewer accidents**

All of this means increased production uptime and improved operations.

Solutions for challenging applications

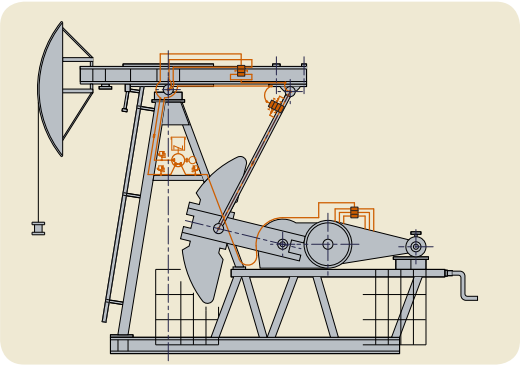
The demands of energy exploration and production are increasing as more challenging locations need to be tapped. The production of unconventional oils and gases is becoming more common, and complex offshore oil fields require deep drilling as well as sub-sea operations. Upstream, midstream or downstream, SKF supports you in every phase by providing automatic lubrication systems that are tailored to the specific characteristics of the job.

Keep pumps running

Whether drawing oil from the bottom of the ocean or subsurface, pumping systems must operate efficiently and reliably to maintain productivity.

A wide range of pumps are used in the industry. Regardless of low or high pressure or small or large volumes, the bearings on these pumping units must be lubricated. Often these lubrication points are in difficult-to-access areas.

All components of SKF and Lincoln progressive or multi-line lubrication systems are well protected against environmental effects. In addition, you can monitor and adjust the lubrication pumps remotely, maximizing worker safety.



Increase packing life

When it comes to horizontal drilling, the equipment operates longer hours at higher pressures. This places reliability demands on fracturing pumping equipment.

SKF offers lubrication systems to prolong packing life. Our Triplex and Quintaplex pumps frequently deliver precise amounts of lubricant to the friction points, lowering lubricant consumption costs. By using these systems, packing life can be increased up to five to 10 times when compared to conventional oil lubrication systems.

Lincoln Centro-Matic and Quicklub lubrication systems have been used successfully for decades to lubricate mining and construction equipment, and these systems also are offered to lubricate fracturing support equipment such as blenders, cement pumps or sand conveying machines.

In addition, SKF offers shop and general lubrication products, including hoses and reels, as part of our comprehensive line to support well service equipment.

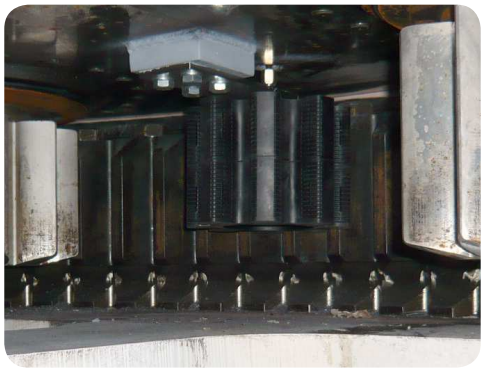
Minimize accidents

In addition to the main gear rim, a crane has multiple lubrication points to help ensure that all joints function properly, even under harsh ambient conditions.

Automatic lubrication systems provide a consistent supply of grease to these difficult-to-reach lubrication points without having to interrupt operations, and maintenance technicians no longer need to climb to each lubrication point, thereby increasing safety.

SKF offers a wide range of components for off-shore cranes, including the Lincoln ZPU pump, which is available in an ATEX-approved version. With a reservoir capacity of up to 100 kg *(220 lb)*, one pump unit can provide an automatic supply to all lubrication points on a crane.

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

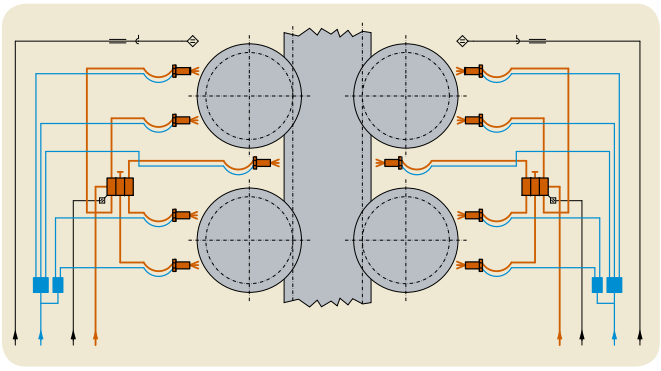


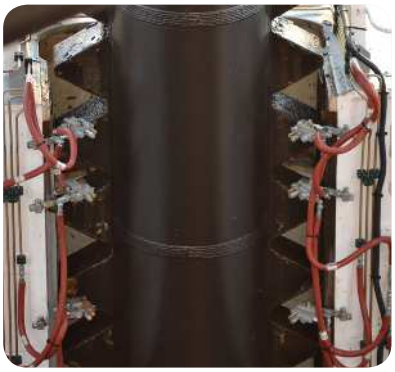
Lubricating tooth by tooth

Jacking systems work under extreme environmental conditions, so proper lubrication is essential to significantly reduce the wear of the drive pinion and tooth flanges.

One option is to connect the pinions directly to an automatic lubrication system, such as Lincoln's single-line Centro-Matic system, which can be fed lubricant by a FlowMaster pump. Another option is to use a multi-line progressive system to feed lubricant to a lubrication pinion.

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. Lincoln's pneumatically driven PowerMaster pump supplies the grease to the nozzles, which provide an adjustable spray pattern up to 150 mm (6 *in.*). Electrically monitored nozzles are available upon request.





Valve lubrication and wireline pressure control pumps

SKF's line of Lincoln air and hydraulically driven high-pressure grease pumps is used for a variety of demanding applications in the oil and gas industry. From delivering valve sealant to a well-head valve stack to pumping grease at extreme pressures for wireline pressure control, these pumps are recognized throughout the industry.

During a wireline logging event, pressures can range from 345 to 1 035 bar (*5 000 to 15 000 psi*). Maintaining a liquid (grease) seal at these pressures is a must to safely and accurately log a well. Lincoln's PowerMaster pumps have been a standard in the industry, reliably delivering lubricant at extreme pressures to help ensure successful well logging.

In a lubricated plug valve, gate valve or ball valve, re-lubrication is a critical preventative maintenance measure to reduce friction and provide port sealing. Lincoln pumps are proven performers in delivering the lubricant-sealant at extreme pressures, ensuring dependable valve performance.

PowerMaster Ultra high-pressure pumps can be mounted on a drum or tank and require minimal space when mounted on a skid or truck.

Complete in-shop and mobile truck maintenance equipment

SKF's comprehensive Lincoln line of performance-proven pumps, hose reels, controllers, grease guns and fluid inventory control systems offers everything needed to build a fully functional lubrication station.

From tools developed to pump and dispense to those designed to accurately track the use of fluids, oils and greases, SKF offers dependable solutions for vehicle maintenance applications.

Onboard automatic lubrication for well service trucks and equipment

Well service trucks tend to operate in rough terrain while traveling to the well site. Onboard automatic lubrication systems are designed to inject frequent, metered shots of grease to the chassis components. This serves to flush out and seal against the ingression of harmful contaminants, such as caliche dust and dirt.

The benefit is prolonged asset life, minimized maintenance costs and improved equipment availability. Onboard automatic lubrication systems are proven within the industry, helping to ensure that these vehicles operate safely and efficiently whereever they go.

Lubricating and cooling at the same time

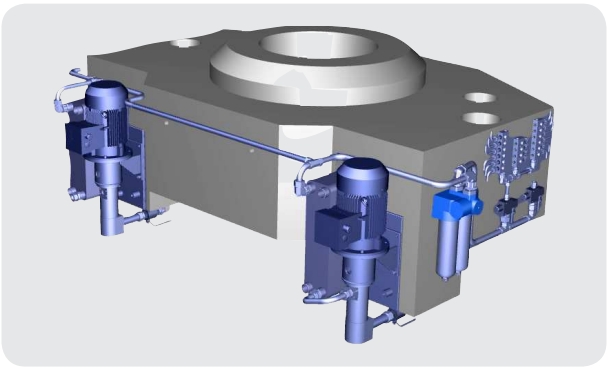
Heavy loaded bearings on top drives, gearboxes or very large motors need special attention. The solution is a circulating oil lubrication system that separates dirt particles, air bubbles and water from the oil. A pressurized oil system transports the lubricant to the individually adjustable flow meters. In case of cold external temperatures, an electrical heater can be used to provide optimal startup temperature in the lubrication cycle.

These customer-specific solutions are 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 difficult 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 from 1 to 3 000 l/min (*0.26 to 792 gal/min*).

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, for example up to ATEX zone 1, or in compliance with relevant standards such as the American Petroleum Institute's (API) Standard 614.



Support for climatization

Induced and forced draft fans are key components in maintaining a desired climate. If they fail, it could lead to disruption of the production process. Lubrication points on the fans, which are often difficult to access, require regular lubrication.

SKF and Lincoln single-line or dual-line automatic lubrication systems provide optimum supply to all lubrication points by helping to prevent both insufficient and excessive lubrication of the bearings. This is a proven way to eliminate sudden failures resulting from bearing damage caused by improper lubrication. Lubrication can be performed with grease or oil, depending on the size of the system and the temperatures encountered.

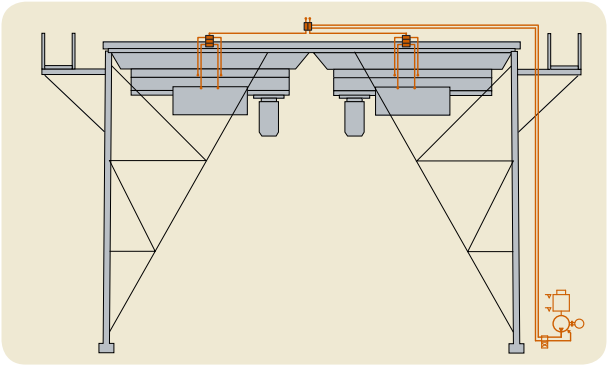
The drive section of cooling fans, which climatizes the system without water in hot regions, can be lubricated and cooled with SKF circulating oil systems.

Effective, continuous lubrication

Oil mist lubrication systems are used to service all types of machine elements that require continuous lubrication. The most common applications are roller bearings in pumps, electric motor drivers, blowers and fans. Oil mist lubrication systems are found in refiners and chemical plants worldwide.

The system utilizes compressed air mixed with oil to atomize the oil into 3 to 5 micron size particles. This mixture of oil and air produced by the generator is known as oil mist, which can be conveyed a distance as far as 180 meters (*600 feet*). It is conveyed through a distribution header and tubing to the point of required lubrication. One oil mist system can provide lubrication up to sixty or more pieces of equipment and their drivers.

Designed with no moving parts for a long service life, oil mist lubrication systems minimize lubricant consumption, making them a cost effective lubrication option. Oil mist lubrication systems help bearings to run cooler, lowering the operating temperature helps to increase the bearing life.



Smart lubrication

Compressors in hydrocarbon processing facilities fit into one of three categories:

- **Centrifugal compressors, which must endure high speeds and temperatures;**
- **Reciprocating compressors, used in low-volume, high-pressure applications; or**
- **Screw compressors, used to distribute natural gas through pipelines under harsh chemical conditions.**

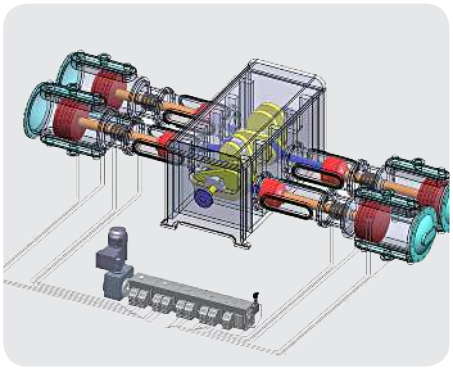
Proper lubrication protects your compressor, extends the life of its critical components and keeps this valued asset generating revenue. SKF has the experience and product portfolio for these lubrication tasks.

Delivering the right amount of oil at the right time to compressor cylinders and rod packing is a critical requirement to keep a natural gas compressor operating efficiently. Under-lubrication can cause damaging metal-to-metal contact that generates excessive heat and results in wear or machine downtime. Over-lubrication essentially wastes money and negatively impacts compressor efficiency and the environment.

Lincoln progressive lubrication systems with 55i box lubricators or MCLP pumps deliver oil accurately and consistently with up to 517 bar (*7 500 psi*). The Lincoln Datalogger monitor tracks and trends lubricant consumption through innovative “smart” technology and helps improve machine reliability and by protecting our compressor from lube system failures.

Depending on the pressure range, piston compressors may require a pump-to-point solution that also ensures reliable functioning at high back pressures. SKFs JM pumps are specially designed for this type of compressor and supply precisely metered volumes of lubricating oil at pressures up to 600 bar (*8 500 psi*). The SP/PFE pump is a plug-and-play solution for Polyethylene (LDPE) hyper compressors up to 4 000 bar (*58 000 psi*). For low-pressure compressors, SKF offers the smaller SP/G pump unit. Pulse generators of series SP/SFE30 monitor the volumetric flow of the oil.

The lubrication system helps to ensure that the piston area, packing and bearings are supplied with the required quantity of oil, reducing friction and increasing service life. In addition, feeding tempered lubricating oil serves to remove heat from the system.



Comprehensive range of lubrication components

SKF offers a comprehensive range of high-quality lubrication pumps, metering devices, control and monitoring units and all necessary accessories for your specific lubrication solution. Individual components are coated for protection against corrosion (corrosion class C5 M) and combined with stainless steel for durability. Explosion-approved and class-certified components are available upon request.

Lubrication pumps

Certain criteria, such as ambient conditions, required delivery rates, lubricant used and service intervals, determine which lubrication pump should be selected. These pumps are available with varying control and monitoring options.

SKF's portfolio includes mechanically, electrically, hydraulically and pneumatically driven pumps. These pumps feature weather-resistant housings, and saltwater-resistant versions also are available. Operating efficiently in low working temperatures, these pumps are suitable for oil and standard greases up to NLGI Grade 2. In addition, certain pumps are appropriate for NLGI Grade 3 grease.

Our offering ranges from single-point automatic lubricators and pump units with integrated grease reservoirs for single-, dual- or multi-line lubrication systems to tailored pumps for circulating oil systems.

Lubricant metering devices

Depending on the type of lubrication system selected, specific metering devices are required. All metering devices feature high-precision components and are available in versions suitable for various climates and pressures. System operation can be verified easily through electronic or visual monitoring.

The SKF offering is completed by additional system components including spray nozzles and lubricating pinions for open gear lubrication.

Oil lubrication components suitable for pressure up to 4 000 bar (58 000 psi)

Monitoring

Monitoring and control are essential to the efficient operation of a lubrication system. When installed in conjunction with intelligent monitoring devices, an automatic lubrication system can facilitate economical and optimal lubrication.

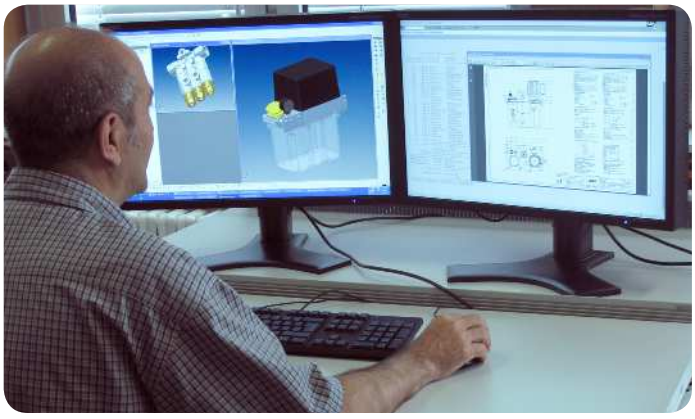
With the instruments we provide, you have access to all values important for controlling your system – temperature, pressure, volumetric flow or fill level – whether through visual monitoring or by utilizing digital or analog signal.

SKF has developed many of our products specifically for use in potentially explosive atmospheres. We meet 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).

Grease lubrication components suitable for pressure up to 400 bar (5 800 psi)

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 assume responsibility for maintenance and repair 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 inside oil and gas plants to appropriate fittings and accessories.

Procurement logistics and synchronized production

SKF 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 oil and gas industry since its inception and offers deep knowledge of the complicated mechanical interrelationships inherent in oil and gas energy technology. 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 across the globe.

Whatever the size or design of your plant, 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.

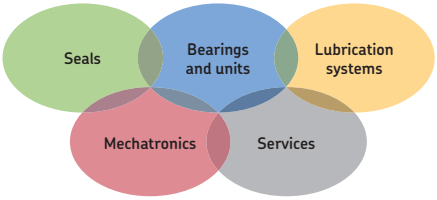
A network of experienced partners

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**
- **Oil and gas 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.

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