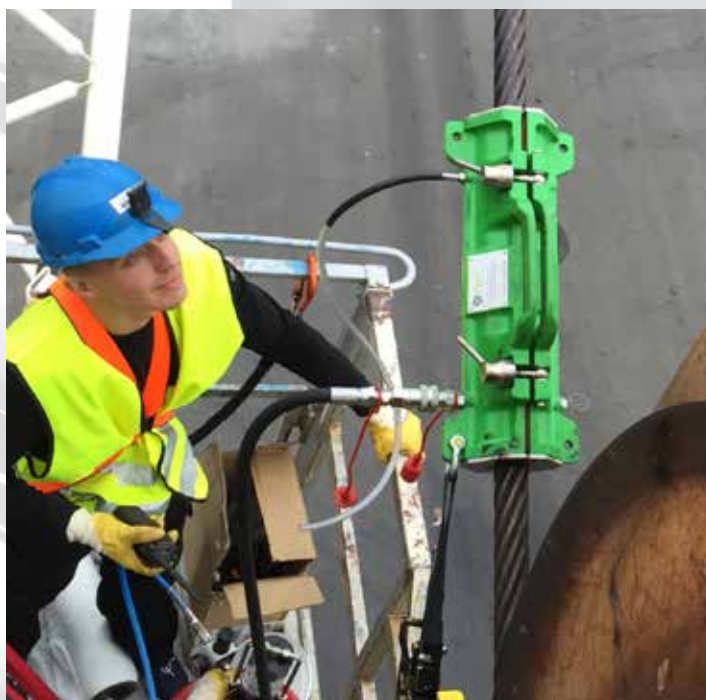




***LUBRICATION
ENGINEERS®***

MARINE & SHIPPING APPLICATION

Lubrication Solutions



Suffering points got y

Keep your ship's equipment running with comprehensive

Shipping and marine companies alike can benefit from the standout mix of products, services, knowledge and experience offered by Lubrication Engineers, Inc. With years of experience in the field, we understand the unique challenges presented by these operations and can help you take care of your valuable shipping assets while lowering your costs.

LE's enhanced lubricants, made of highly refined base oils and proprietary additives, far exceed the performance of conventional lubricants in a variety of applications. They extend lubrication intervals and equipment life and significantly reduce wear, energy use, downtime and maintenance, thereby recovering the initial cost of the lubricant many times over.

Marine Engines

Problems

Short oil life, engine wear, expensive downtime & disposal

- Shortened life of the engine oil & engine
- Deposit & wear formation
- Expensive disposal of used engine oil

LE Solutions

Monolec Ultra® Engine Oil & Monolec® GFS Engine Oils

- Cost savings due to long life (60% savings recorded)
- Superior wear protection
- Reduced engine oil consumption & disposal
- Increased fuel efficiency

RDE Engine Oil

- Designed to protect silver alloy bearings from wear and contamination
- Increases the engine lifespan

Xamine® Engine Oil Analysis Program

- Recommended for extended drain interval applications in reciprocating engines such as those found in marine fleets. It monitors wear and contamination and optimizes drain intervals.



Monolec Engine Oils provide excellent wear protection and have an ability to clean engines. This leads to reduced downtime and extended engine life due to improved reliability.

Wire Ropes

Problems

Water wash-off, rust & oxidation, difficulty in lubricating safely

- Rust & corrosion formation
- Reduced lubricant performance
- Shortened life of lubricant & wire ropes

LE Solutions

Wirelife® & Earthwise™ EAL Wire Rope Lubricants*

- Water wash-out resistance
- Superior rust protection

Viper Wire Rope Lubricator

- Enables fast & effective lubrication of wire ropes
- Lubricates ropes from 5/16" to 6 1/2" in diameter
- Provides lubricant penetration and protection against corrosion



Mooring wire ropes lubricated with grease applied by a Viper Wire Rope Lubricator.



Viper Wire Rope Lubricators can quickly, safely and efficiently lubricate wire ropes at speeds of up to 2,187 yards per hour.

* See last page.

you down?

nsive approach

We also offer a full line of lubrication reliability products and services, including solutions for oil analysis, storage, handling and transfer, contamination exclusion and removal, and education and training. Whether you need a solution to a single challenge or help setting up a complete lubrication reliability program for your fleet, you can turn to LE for help.



Anchor Windlass

Problems

Water wash-off, lubricant pound-out, rust & oxidation

- Rust & corrosion formation
- Reduced lubricant performance
- Shortened life of lubricant and bearings
- Relubrication required with every use of anchor windlass (at least 12 times every six months)

LE Solutions

Almagard® Vari-Purpose Lubricant (NLGI 2)

- Provides superior EP protection for heavily loaded bearings
- No pound-out or wash-out of bearings
- Imparts superior rust protection
- Requires lubrication only **once** every six months



Anchor windlass lubricated with commercial grease – note the development of rust and wear as well as a lack of lubricant.



Anchor windlass lubricated with Almagard Vari-Purpose Lubricant – note the lack of any rust or wear on the windlass.

On Board Crane Slewing Bearings

Problems

Water wash-off, lubricant pound-out, vibration, rust & oxidation

- Rust & corrosion formation
- High grease consumption
- High cost of bearing repair, replacement and downtime
- Shortened life of lubricant and bearings

LE Solutions

Manual Lubrication:

Almagard® Vari-Purpose Lubricant (NLGI 1)

Auto-Lube Systems:

Almaplex® Ultra Syn Grease

- Superior EP protection for heavily loaded slewing bearings, preventing fretting corrosion and moisture contamination as well as eliminating wear
- Superior rust protection
- Relubrication interval of bearings increased – less annual grease consumption



LE's Almagard & Almaplex greases allow customers to dramatically reduce the lubricant consumption for their slew bearings due to superior EP protection and their resistance to pound-out and water wash-off/spray-off.

Enhanced Lubricants

Reduce friction and wear, enabling equipment to operate longer and more efficiently

- Technologically advanced oils and greases
- Proprietary, high-performance additives
- Selected to meet needs of specific applications

Xpert Equipment Reliability Assessment

Maximizes equipment life, reduces downtime, consolidates lubricant inventory

- Professional onsite assessment of all equipment requiring lubrication
- Detailed report recommending lubricants, application methods, usage amounts, and drain or lube intervals
- Recommendations also include reliability solutions for transfer, contamination removal, education and training.

Design, Implementation & Support

Initiates and maintains a Lubrication Reliability Program

- Best practices approach
- Local MLT and/or CLS trained lubrication consultant
- Corporate technical support

Xpert Education & Training

Ensures knowledgeable employees and sustainable improvements

- Onsite, public and online course options
- Consulting services

Xtract® Contamination Removal

Protects and enhances performance of valuable lubricants and machinery

- Sight glasses for monitoring oil levels, inspecting oil and removing water
- Mobile and stationary filtration carts for achieving oil's ISO cleanliness target



Enhanced Lubricants

Xpert Reliability Assessment



Xpert Design, Implementation & Support



Xpert Education & Training

Training Manager

"Our business is ensuring equipment reliability through lubrication best practices. We protect your production equipment with the right lubricant, in the right place, at the right time, with the right quality, condition and quantity."



Xtract® Contamination Removal

Prote VESS

with LE's
Full Circle
of Reliability
*Starting with
our enhanced
lubricants*



**Xamine®
Oil Analysis**

**Xpel® Storage
& Identification**



**Xport®
Lubricant
Application**



Protect Your EQUIPMENT

Lubrication Engineers will work closely with you to learn about your specific equipment and lubrication needs. Only then can we create an effective lubrication reliability program that will provide the equipment protection and enhanced profits you are seeking.

This starts with an onboard assessment of all equipment requiring lubrication. A trained, local LE lubrication consultant will provide you with a detailed report recommending lubricants, application methods, usage amounts, and drain or lube intervals. In addition to LE's comprehensive line of premium lubricants, your LE consultant can offer you all of the other Asset Reliability Solutions shown here to ensure the effectiveness of your program.



**Xclude®
Contamination Exclusion**

Xamine® Oil Analysis

Establishes optimum drain intervals and detects wear or contamination before it damages equipment

- Comprehensive program for routine monitoring of oil performance and equipment conditions
- Fast, accurate, online reporting and expert explanation of results
- Sampling valves and other equipment for ensuring consistent oil samples

Xpel® Lubricant Storage & Identification

Keeps lubricants contamination-free and ensures clean and organized lube rooms, worker safety and consistent lubricant quality

- Storage systems to ensure oil cleanliness, inventory control and application efficiency
- Transporting, pumping and dispensing equipment
- Color-coding and ID tags to prevent misapplication and cross-contamination

Xport® Lubricant Application

Keeps equipment properly lubricated for optimum performance

- Customizable automatic lubrication systems
- Single- or multi-point grease lubricators
- Clear Grease Guns with color-coded grease fitting
- Viper Wire Rope Lubricator for efficient lubrication of wire ropes

Xclude® Contamination Exclusion

Protects and enhances performance of valuable lubricants and machinery

- Desiccant breathers for absorbing moisture and preventing particulate ingestion
- Adapters and quick connect couplers for preventing contamination at drum and equipment level

LE Provides Solutions for Ma

Prevention is always the best solution. It is easier and more cost-effective to put clean lubricant into your machinery and keep it clean and dry than it is to remove water and other contaminants after they've got into the lubricant. In the real world, however, a multipronged approach that includes both prevention and removal is needed. We've identified some of the most common problems that arise on ships, along with our recommended solutions.

Water Ingression

Condensation & seawater contamination inside gearboxes and pumps is a common problem that leads to costly downtime and repairs for vessels. This could be caused by moisture in the air that is breathed into the equipment or by a loss of integrity in the seal.



LE Solution

- **Desiccant breathers** remove moisture from air as it is breathed in and out.
- **Sight glasses** show how much water is in the oil and allow easy drain-off.
- **Filtration** is recommended for gearboxes that are critical to the operation or larger than 20 gallons.
- **Lubricants with demulsibility characteristics** keep water separate from oil so it can be removed.

Each of these solutions helps to an extent, but it is the synergy of all four together that will maximize your benefits. For example, a sight glass that allows you to drain the water only works if you have a good lubricant that keeps the water separate from the oil. On the flip side, even the best oil can only fight emulsification for so long if there are no efforts to prevent or drain off the water.

Water Washout

Components such as gears, bearings, chains and cables are in water all of the time or go in and out of water frequently. Some commercial quality greases are removed or weakened by this constant exposure to water.



LE Solution

- **Water-resistant greases** will adhere better to metal due to polymeric content or not be washed off by frequent exposure to water due to the inherent water-resistant nature of their thickener. In addition, the grease must not build up or it will change the tolerance of the component.
- **Clear Grease Guns** make it easy for you to know which grease you're using for each application, eliminating the possibility of the wrong grease being applied or two different greases being mixed.
- **Training** ensures that your personnel know the proper storage, handling and application procedures for your greases and other lubricants. LE will train your team onsite at your convenience.

Rust & Corrosion

Seawater contamination is an obvious & naturally very common problem for all marine equipment. It leads to rust & corrosion that often then leads to shortened equipment life and increased downtime.



LE Solution

- **Lubricant quality** is crucial for protecting critical components such as bearings and gears.
 - » The **viscosity of the base fluid** should be chosen specifically for the application. The appropriate viscosity ensures a strong hydrodynamic film that will transport rust particles out of the contact zone. The viscosity must be maintained, even in the presence of water and high temperatures, or the integrity of the film will suffer.
 - » **Rust and oxidation inhibitors** are essential for preventing rust and oxidation in the first place.
 - » **Anti-wear additives** protect the metal surfaces from abrasive wear if rust particles are already present.
- **Filtration** can be used to remove the rust particles from the lubricant after they have been carried away from the contact zone.
- **Viper Wire Rope Lubricator** can be used to seal moisture out of the wire rope core and protect against corrosion.

What's Your Problem?

No matter what reliability problems your ships are experiencing, LE has the expertise, products and services to create the best solutions for you. There's no need to go it alone when you can contact your local LE consultant for help today.

Marine & Shipping Companies

Enhanced Lubricants

From LE's broad offering of premium lubricants that are available in a wide range of penetration and viscosity grades, we will make recommendations based on your specific application and equipment needs. Below is a list of LE lubricants that have provided years of reliable service for marine and shipping companies around the world, along with the most common uses for them. For detailed descriptions and technical information, visit the product pages at] www.LElubricants.com, refer to individual product flyers available online or in print, or contact your local LE consultant for assistance.



Greases

General grease fittings

- Almaplex® Industrial Lubricant (1274-1275)
- Monocal® GP Grease (1498-1499)
- Almaplex® Ultra-Syn Lubricant (1297-1299)
- Almagard® Vari-Purpose Lubricant (3750-3752)
- Monolec® Multiplex Lubricant (4622)
- Monolec® Industrial Lubricant (4700-4702)

Windlasses, pedestal fairleads, lifeboat davits, steering & turning gear

- Almagard® Vari-Purpose Lubricant (3750-3752)

Open Gear Lubricants

Open gears

- Pyroshield® Syn Open Gear Grease (5100, 5180 & 5182)
- Syntemp® Synthetic Lubricant (9102)

Gear Oils

Gear reducers, enclosed gears, shaft bearings, turning gear, thrusters

- Duolec® Industrial Gear Oil (1601-1610, 1302, 1304)
- Duolec® PAG Gear Lubricant (9705-9707)
- Duolec® Syn Gear Lubricant (9815-9846)

Industrial Oils

Pump & motor bearings, steering gear, air compressors, hydraulics, turbines, turbocharger

- Equipower™ Hydraulic Oil (4932-4934)
- Equipower™ Ultra Hydraulic Oil (6132, 6146, 6168)
- Equipower™ Ultra HVI Hydraulic Oil (6522, 6532, 6546)
- Monolec® R&O Compressor/Turbine Oil (6401-6407)
- Multilec® Industrial Oil (6801-6807)

Engine Oils, Transmission Fluids & Fuel Supplements

Diesel & gasoline engines, transmissions, converters

- L-X® Heavy-Duty Chemical Supplement (2300)
- Full Torque™ Diesel Fuel Improvers (2411-2421)
- Monolec® Drive Train Fluid (7511-7551)
- Monolec Ultra® Engine Oil (8800-8801, 8130-8131)
- Monolec® GFS Engine Oil (8430-8450)

Aerosols & Wire Rope Lubricants

Wire Ropes, chains, cables, frozen parts

- Earthwise™ EAL Wire Rope Lubricant (3353)*
- Wirelife® Almasol® Coating Grease (451-453)
- Wirelife® Monolec Penetrating Lubricant (2001)
- Wirelife® Almasol Coating Lubricant (2002)
- Wirelife® Low Tox Penetrating Lubricant (2011)
- Monolex® Penetrating Oil and Lubricant (2059)

Environmentally Friendly Lubricants

- Earthwise™ EAL Wire Rope Lubricant (3353)*
- Low Tox® Turbine Oil (6412-6414)
- Low Tox® Hydraulic Oil (6603)
- WireLife® Low Tox Penetrating Lubricant (2011)

* See last page.



Does your lubricant supplier do all of this?

If your lubricant supplier does not provide the products and services listed below as part of its lubrication reliability program, perhaps it is time to change suppliers.

- ✓ Professional, onsite equipment reliability assessment
- ✓ Comprehensive lubricant line (industrial oils, engine oils and greases)
- ✓ Web-based oil analysis, with results reviewed by experts
- ✓ Storage systems, including stackable bulk units
- ✓ Visual identification, including tags, labels, color-coding and wall charts
- ✓ Handling and transfer equipment, including portable transfer containers, clear grease guns, grease pumps, hose reels and the Viper wire rope lubricator
- ✓ Single- and multi-point automatic grease lubricators and lubricating systems
- ✓ Contamination exclusion and removal tools, including oil reservoir sight glasses, desiccant breathers and filtration equipment
- ✓ Local, factory-trained specialist available 24/7



* **Earthwise, EAL & VGP**

Well-suited for applications in or around waterways, LE's Earthwise™ EAL Wire Rope Lubricant is a VGP-compliant EAL. This grease is specifically formulated to be earth friendly, while still meeting the rigorous demands of industrial applications, including those with significant water exposure. EAL is an environmentally acceptable lubricant that is biodegradable and minimally toxic, and is not bioaccumulative – as defined in Appendix A of the 2013 VGP. With this product, you can “go green” – and keep up with the latest environmental regulations – without having to sacrifice performance.

Monolec Ultra®, Monolec®, Wirelife®, Almagard®, Almaplex®, Monocal®, Pyroshield®, Syntemp®, Duolec®, Multilec®, L-X®, Monolex®, Low Tox®, Xamine®, Xtract®, Xamine®, Xpel®, Xport® and Xclude® are registered trademarks of Lubrication Engineers, Inc. Earthwise™, Equipower™ and Full Torque™ are trademarks of Lubrication Engineers, Inc.
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LI10020 11-16, rev. 12-22