

Wire Rope News & Sling Technology

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Lubrication Plays Major Role in Wire Rope Maintenance and Longevity

by Peter Hildebrandt

Though not the most glamorous of topics, lubrication is of tremendous importance in the maintenance and longevity of wire ropes. A vital part of many different types of machines and structures, wire rope is comprised of continuous wire strands wound around a central core. Most wire ropes are made up of strands of steel wire wound with each other. The core can be made of steel, rope or even plastics.

Many types of machines and structures use wire ropes, including draglines, cranes, elevators, shovels, drilling rigs, suspension bridges and cable-stayed towers. Each application has specific needs for the type and size of wire rope required. All wire ropes, regardless of the application, will perform at a higher level, last longer and provide greater user benefits when properly maintained.

Lubrication Engineers, Inc. is an industrial lubricant company that makes high-performance lubricants designed specifically for a variety of applications and industries. LE manufactures lubricants specially suited for protecting wire rope.

LE has found through years of field

experience that longer wire rope life can be obtained through the use of penetrating lubricants, either alone or when used in conjunction with a coating lubricant. Practical experience at a South African mine suggests that life cycles may be doubled with this approach. At one mine site, the replacement rate for four 44-mm ropes was extended from an average 18.5 months to 43 months. At another mine, life cycles of four 43-mm x 2073 meter ropes were extended from an average eight to 12 months.



Freshly greased wire rope comes out of the back end of the Viper automatic lubricating unit.

In another study involving 5-ton and 10-ton overhead cranes in the United States that used 3/8-inch and 5/8-inch diameter ropes, the average life of the ropes was doubled. The authors attribute this increased performance to the ability of the penetrating lubricant to displace water and contaminants while replacing them with oil, which reduces the wear and corrosion occurring throughout the rope. A good spray with penetrating wire rope lubricant effectively acts as an oil change for wire ropes.

In these examples, the savings in wire rope replacement costs (downtime, labor and capital costs) were substantial and dwarfed the cost of the lubricants. Companies that have realized the importance of proper wire rope lubrication have gained a huge advantage over those that purchase the lowest priced lubricant, or no lubricant at all, while replacing ropes on a much more frequent basis.

Lubrication + Reliability

Unlike other lubricant suppliers, LE also offers solutions on the lubricant reliability side. Over the past several

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Large dockside cranes (also known as container cranes or ship-to-shore cranes) are used for loading and unloading containers from ships. Wire ropes are an essential part of the crane's operation, and they must withstand demanding environmental conditions. Without proper lubrication, they require frequent repair or replacement.

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years, LE has developed partnerships with several companies that offer solutions for keeping lubricants clean and dry throughout their lifetimes. With help from these partners, LE helps its customers keep their lubricants clean and dry, which in turn means that the lubricant and the equipment last longer.

“We are going to market with a one-two punch,” explains Paul Grimes, Marketing Manager for Lubrication Engineers. “We have the high-performance lubricant on one hand and the reliability component on the other. We are trying to teach users of our products best practices to ensure the best results.”

For example, LE has found that many people still use hand application to lubricate wire ropes. They place the

lubricant on a rag and apply it directly to the rope. This does not thoroughly, adequately do the job, Grimes says. It is also time-consuming and a house-keeping challenge, as well as detrimental to the environment because of the mess created during application.

“To help our customers with this problem, we offer the Viper Wire Rope Lubricator,” Grimes says. “The Viper is a small unit that can be attached to the wire rope. It pumps lubricant to the core of the rope, where it needs to be for maximum protection, and it coats the outer strands as well. Voilà! Out the other side comes a well-lubricated rope.

“We sell the wire rope lubricant and the application method, and we teach our customers the best practices for maintaining their wire rope for a long and useful life,” Grimes adds. “Many people don’t understand lubrication, but this automatic applicator seems to get their attention. Wire rope can be expensive to replace, and in certain situations where safety is an issue, failure is not an option.”

Understanding Wire Ropes

Standard 6x19 designation means that a rope made up of six strands will in turn contain 19 wires in each strand, as explained on LE’s website. Different strand sizes and groupings permit varying degrees of rope flexibility and resistance to crushing and abrasion. Small wires tend to be suited to being bent sharply over small sheaves (pulleys). Large outer wires are preferred when the cable will be rubbed or dragged through abrasives.

There are three types of cores. An independent wire rope core (IWRC) is usually a 6x7 wire rope with a 1x7 wire strand core resulting in a 7x7 wire rope. IWRCs have a higher tensile and bending breaking strength than a fiber core rope and a high resistance to crushing and deformation. A wire strand core (WSC) rope has a single wire strand as its core instead of a multi-strand wire

rope core. WSC ropes are high strength and are largely used as static or standing ropes.

Wire ropes also have fiber cores. Fiber core ropes were conventionally made with sisal rope, but may also use plastic materials. The fiber core ropes have less strength than steel core ropes. Fiber core ropes are quite flexible and are used in many overhead crane applications.

The lay of a wire rope is the direction that the wire strands and the strands in the cable twist. There are four common lays: right lay, left lay, regular lay and lang lay. In a right lay rope the strands twist to the right as it winds away from the observer.

A left lay twists to the left. A regular lay rope has the wires in the strands twisted in the opposite direction from the strands of the cable. In a lang lay rope, the twist of the strands and the wires in the strands are both twisted the same way. Lang lay ropes are said to have better fatigue resistance due to the flatter exposure of the wires.

Wire ropes are made for the most part from high carbon steel for strength, versatility, resilience and availability and for cost consideration. Wire ropes can be without any coating or galvanized. Several grades of steel are used.

Steel cable wire tends to be stiff and springy. In non-preformed rope construction, broken or cut wires will straighten and stick out of the rope as a burr, posing a safety hazard. A preformed cable is made of wires that are shaped so that they lie naturally in their position in the strand, preventing the wires from protruding and potentially causing injury. Preformed wire ropes also have better fatigue resistance than non-preformed ropes and are ideal for working over small sheaves and around sharp angles.

All of these factors make the lubrication of wire ropes challenging, no matter what the construction and composition. Ropes with fiber cores are somewhat easier to lubricate than those made solely from steel materials. For this reason, it is important to carefully consider the issue of field re-lubrication when selecting rope for an application.

Factors Affecting Wire Rope Performance

A wire rope’s life cycle and performance are influenced by several factors, including type of operation, care and environment. Cables can be damaged by worn sheaves, improper winding and splicing practices, and improp-

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This spool of wire rope shows some of the damage that can occur due to a variety of factors, including worn sheaves, improper winding and splicing practices, improper storage, high stress loading, shock loading, corrosion, oxidation, and abrasive wear.



Wire rope that is properly treated on a regular basis with penetrating and coating lubricants will be protected from the elements and other negative factors and will provide a longer useful service life.

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er storage. High stress loading, shock loading, jerking heavy loads or rapid acceleration or deceleration (speed of the cable stopping and starting) will accelerate the wear rate.

Corrosion can cause shortened rope life due to metal loss, pitting and stress risers from pitting. If a machine is to be shut down for an extended period, the cables should be removed, cleaned, lubricated and properly stored. In service, corrosion and oxidation are caused by fumes, acids, salt brines, sulfur, gases, salt air, humidity and are accelerated by elevated temperatures. Proper and adequate lubricant application in the field can reduce corrosive attack of the cable.

Abrasive wear occurs on the inside and outside of wire ropes. Individual strands inside the rope move and rub against one another during normal operation, creating internal two-body abrasive wear. The outside of the cable accumulates dirt and contaminants from sheaves and drums. This causes three-body abrasive wear, which erodes the outer wires and strands. Abrasive wear usually reduces rope diameter and can result in core failure and internal wire breakage. Penetrating wire

rope lubricants reduce abrasive wear inside the rope and also wash off the external surfaces to remove contaminants and dirt.

Understanding Wire Rope Lubricants

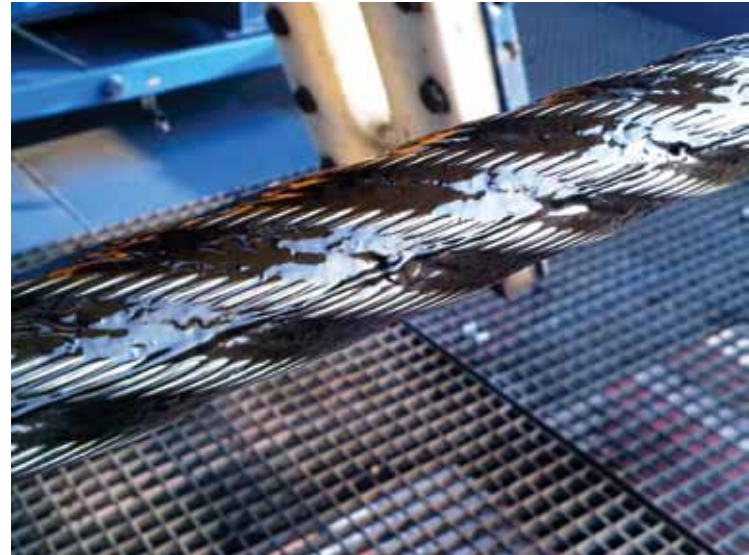
Wire rope lubricants function to both reduce friction as the individual wires move over each other and to provide corrosion protection and lubrication in the core and inside wires and on the exterior surfaces. Penetrating and coating lubricants do the work.

Penetrating lubricants contain a petroleum solvent to carry the lubricant into the core of the wire rope before it evaporates. Behind is left a heavy lubricating film protecting and lubricating each strand. Coating lubricants penetrate slightly, sealing the outside of the cable from moisture and reducing wear and fretting corrosion from contact with external bodies.

Both types of wire

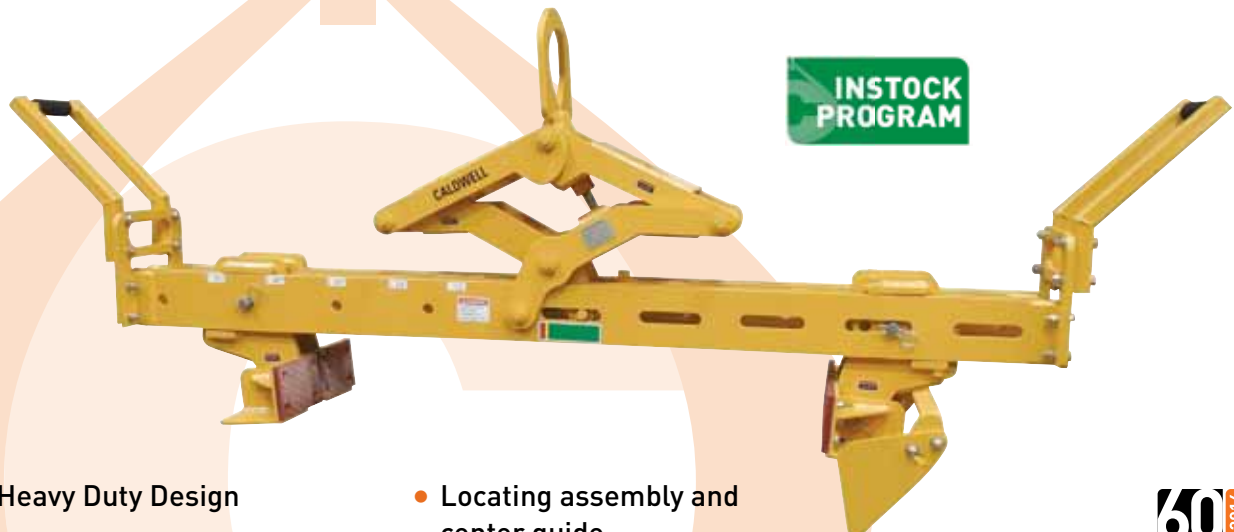
rope lubricants are used. Because many wire ropes fail from the inside, it is crucial to make sure that the center core receives adequate lubricant. A combination plan of attack in which a penetrating lubricant is used to saturate the core, followed with a coating to seal and protect the outer surface, is advised. Wire rope lubricants can be

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This section of wire rope has just been lubricated with an LE lubricant, applied with the Viper automatic lubricator.

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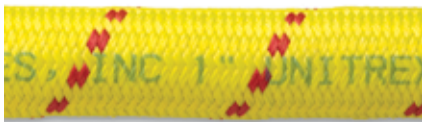


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petrolatum, asphaltic, grease, petroleum oils or even vegetable oil-based.

Petrolatum compounds, with the proper additives, provide excellent corrosion and water resistance. In addition, petrolatum compounds are translucent, allowing the technician to perform visible inspection. Petrolatum lubricants can drip off at higher temperatures but maintain their consistency well under cold temperature conditions.

Asphaltics are the coating type of lubricant. Asphaltic compounds typically dry to a very dark hardened surface, which makes inspection difficult. They adhere well for extended long-term storage but will crack and become brittle in cold climates.

Various types of greases are used for wire rope lubrication. These are the coating types that penetrate partly but usually do not saturate the rope core. Common grease thickeners include sodium, lithium, lithium complex and aluminum complex soaps. Greases used for this application in general have a soft semi-fluid consistency. They coat and achieve partial penetration if applied with pressure lubricators.

Petroleum and vegetable oils penetrate best and are the easiest to apply because proper additive design of these penetrating types gives them superior wear and corrosion resistance. The fluid property of oil type lubricants helps to wash the rope to remove abrasive external contaminants.

Some key performance attributes to look for in a wire rope lubricant are wear resistance and corrosion prevention. Some useful performance benchmarks include high four-ball EP test values, such as a weld point (ASTM D2783) of above 350 kg and a load wear index of above 50. For corrosion protection, look for wire rope lubricants with salt spray (ASTM B117) resistance values greater than 60 hours and humidity cabinet (ASTM D1748) values of more than 60 days. Most manufacturers provide this type of data on product data sheets.

LE is also working to make lubricants more environmentally friendly. Unlike other biodegradable oils that break down quickly but with relatively high

toxicity, LE's Wirelife Low Tox Penetrating Lubricant biodegrades slowly but with less toxicity, minimizing environmental impact and posing less danger to aquatic life. It is designed for marine environments and other applications where environmental concerns require the use of a very low toxicity wire rope and chain lubricant.

Relubrication of Wire Ropes

Wire ropes are lubricated during the manufacturing process. If the rope has a fiber core center, the fiber will be lubricated with a mineral oil or petrolatum type lubricant. The core will absorb the lubricant and function as a reservoir for prolonged lubrication while in service. If the rope has a steel core, the lubricant (both oil and grease



This 100-mm non-rotating wire rope used on an offshore crane is totally dry and covered in ice and snow prior to lubrication.

type) is pumped in a stream just ahead of the die that twists the wires into a strand. This allows complete coverage of all wires.

After the cable is put into service, relubrication is required due to loss of the original lubricant from loading, bending and stretching of the cable. The fiber core cables dry out over time due to heat from evaporation, and they often absorb moisture. Field relubrication is necessary to minimize corrosion, protect and preserve the rope core and wires, and thus extend the service life of the wire rope.

If a cable is dirty or has accumulated layers of hardened lubricant or other contaminants, it must be cleaned with a wire brush and petroleum solvent, compressed air or steam cleaner before relubrication. The wire rope must then be dried and lubricated right away to prevent rusting. Field lubricants can be applied by spray, brush, dip, drip or pressure boot.

Lubricants are best applied at a
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drum or sheave where the rope strands have a tendency to separate slightly due to bending to facilitate maximum penetration to the core. If a pressure boot application is used, the lubricant is applied to the rope under slight tension in a straight condition. Excessive lubricant application should be avoided to prevent safety hazards.

Wire Rope Application

Wire rope lubrication for various applications has not always been clearly understood or performed by users. Wire ropes can be lubricated with either coating lubricants or penetrating lubricants or both.

Penetrating lubricants get into the core of the wire rope itself, leaving a film. But many users have wire rope used in wet, saltwater, cold or other rigorous outdoor environments and they are interested in a coating lubricant that seals out contaminants so they never get to the core of the rope. Some situations require both types: a penetrating lubricant to start, followed by a coating to seal out the elements.

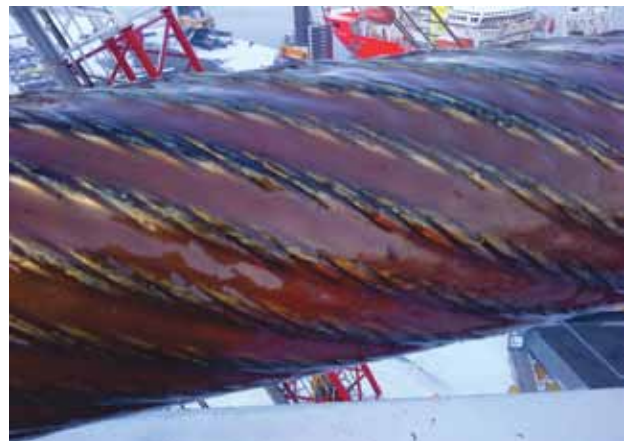
"If you actually use both of these products and get the lubricant into the core of the rope using an automatic lubricator, what you get is a nice clean-looking

rope," Grimes says. "The lubricants inside the core and the film on the outside mean you can actually apply less lubricant and get it where it needs to be instead of trying to rub it in by hand."

Over the last few years Grimes has recognized that the whole subject of wire rope lubrication seems to be of interest to a lot of people.

"A few years ago, we gathered our wire rope, cable and chain lubricants and rebranded them with a 'Wirelife' as a family name," Grimes says. "Our strategy was to put some focus on this category based on what we saw in the marketplace.

"In addition to the branding, the nice thing about LE is that we've developed some high-end lubricant technology and innovative solutions. If you use these Wirelife lubricants, they are going to protect the rope longer; the rope won't break or fray. If you use the Viper automatic applicator, it will im-



The same 100-mm non-rotating wire rope is shown after it was lubricated with LE's Wirelife Almasol Coating Grease using the Viper automatic lubricator. Notice the complete coverage of the rope.

prove application efficiency, lubrication coverage and safety. The old method of manually applying lubricant to wire rope is going by the wayside.

"Lubrication is an important subject yet a lot of people still don't understand it," Grimes says. "At LE, we focus on helping the end user be proactive by using the right lubricant, handling and maintenance solutions with wire rope. You can cut corners early on, but you'll probably pay more in the end. I call it jumping over dollars to pick up dimes." **WRN**

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