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Wire rope pressure Iubrication explained

The use of wire rope pressure applicators has now become a main stay in most wire rope maintenance applications worldwide since The Kirkpatrick Group, Inc (TKG) first introduced them to the world market in 1982. Guest writing for Inside Marine, TKG President Bob Kirkpatrick explains the technology and delves into the huge financial gains that are possible by opting for wire rope pressure lubrication as opposed to the laborious hand lubing alternative. Which industries maintain their wire ropes simply because their use has established that the working life of wire rope can be extended over manual application of coatings. In addition, labour savings have proven to be as much as 50 times greater as compared to the labour costs and time spent using manually applied methods. This claim has been proven in independent United States Government testing. The testing was unsolicited by TKG and those reports are available upon request.

An experience confirming this directly was during TKG's trip to the California Maritime Academy. During the tour aboard the training vessel Golden Bear with the Chief Mate, we observed a group of four cadets hand lubing the 7/8" 1,500ft mooring line on the ships front bow inhaul winch.

We asked the crew how long they had been working the job and they said several hours. I responded: "What if I can provide something that will guarantee to do the same job in 30 minutes



Debris coated tow cable being cleaned by groove cleaner as it enters the lubric cation collar



The same freshly cleaned & lubricated tow cable as it passes from the lubrication collar.

and also clean the wire rope providing optimal penetration instead of only surface coating the way you are doing it?" That's all it took to close the deal.

Another example from the San Diego Public Works Center in their own words: "Cleaning and lubricating wire ropes on cranes using the old manual hand method took approximately five eighthour workdays per crane. Using the pressure applicator, wire rope on a crane can now be cleaned and lubricated in one eight-hour day. This represents significant savings in labour costs. The automated pressure wire rope lubricator has reduced PWC San Diego's annual cost of cleaning cables from about \$320,000 a year to approximately \$34,000, a yearly generating savings of approximately \$286,000."

This kind of feedback has helped TKG gain a broad knowledge of what it takes to optimally apply wire rope dressings to wire rope with over 2,000 systems placed during our 35 years in business. This knowledge is a direct result of our own onsite and daily troubleshooting experience that involves direct communication with our users on a worldwide scale who have incorporated our systems into their wire rope preventative maintenance programmes.

The pressure lubrication process defined

A wire rope travels through a cleaning device (groove cleaner) peeling away penetration blocking debris from its outer surface and groove pattern as it enters into a lubrication collar for lubrication. Once inside, the wire rope is exposed to internal pressures that both coat and penetrate every open space within the wire rope \searrow







able to receive the newly applied product. The pressurisation is created by the filling of specially designed internal seals being fed from the pump.

Although the internal pressure generated is adequate for the task at hand, no pressure lubricator is a closed hydraulic system that can generate thousands of pounds of internal pressure as is the case with hydraulic cranes or excavators that incorporate closed hydraulic systems. This is because the wire rope is passing through the lubrication collar removing the internal pressure as the newly treated wire rope travels from the lubrication collar.

Many factors contribute to the level of pressure that exists at any given moment inside the internal seals. These include strand density, consistency of the original lay-up material, penetration blocking debris and wire rope travel speed; a description of each follows. Strand density and configuration of the wire rope being treated is a self-compensating process creating pressure that co-relates to that required to maximise the pressure required for the particular wire rope configuration being treated. Denser strands require more pressure to penetrate and thus will create it due to their very construction. On the other hand, smaller numbers of strands require less pressure to penetrate and thus less pressure is generated because the lubricant more easily travels through them.

Consistency of the original lay-up material, as well as that applied once in the field during maintenance means that higher viscosity products create and require more pressure to penetrate the wire rope. Conversely, lighter viscosity products create and require less pressure to penetrate the wire rope.

You also have to ask: 'how much penetration blocking debris has been removed prior to the lubrication process?' Groove





System shown: Kirkpatrick jumbo system



JU120 system performing maintenance on a 51mm drillship crane hoist cable

cleaners or wire brushes perform this function. And as for the wire rope travel speed, the travel speed must be at a level that keeps the internal seals full. This is also directly related to lubricant viscosity. 'Feed to Speed' is a rule of thumb to abide by – one does not want to remove the lubricant faster than it is being supplied because spotty coating and penetration will occur.

Viscosity of the lubricants used

Post manufacturing preventative maintenance should supplement the original layup material applied at the time of manufacture when each strand can be addressed with a coating prior to closing. There is no better time to coat a wire rope. For this reason, we will always support a highly viscous product being used during the manufacturing process. This product must have the necessary staying power to provide optimal fluid film protection against strand rubbing and friction wear that can occur when the wire rope is placed in service in the field.

Light weight oil protection against friction wear

Using light weight oils as lay-up coatings at the time of manufacture does not achieve the level of protection later when the wire rope is in service as it exposes the wire rope to excessive abrasion. This is because many oil viscosity products can only provide a thin microscopic barrier. Thus, strand rubbing is unavoidable inside the internal strands of the wire rope. These types of lay-up products also do very little to block water penetration; this is true unless a viscous product is later applied by pressure lubrication in a subsequent preventative maintenance schedule.



Pressure lubrication, if feasible, will at least fill every available open space in the wire rope and in doing so, pressures out entrapped water. In the event a viscous coating product is used, a solid barrier is then created against future water penetration.

The photos in this article of a boom hoist cable were sent to us by a large offshore customer. Its original lay-up product was an oil viscosity used by the manufacturer. The customer was then required to use this product as dictated by the manufacturer after delivery to apply it manually by spray to maintain their warranty. The issue was that the contractor's boom hoist cables' longevity was cut by some 40% by following this requirement. He had a problem.

At the advice of a business associate, he contacted TKG's offices requesting our input. I requested that he send me the sample shown in the photos. Very quickly one will note that extensive abrasion and strand rubbing has occurred and no fluid film protection is evident. This is very simply because the coating (oil) product was too thin to maintain on the rope and dripped from it leaving only a microscopic sheen. One can also note that the outer strands have become brittle and are broken and that the inner strands, including the very core (not shown), have gouges from strand rubbing due to a lack of fluid film protection. I called him once I had evaluated the situation and told him quite simply that his problem was created by a lack of lubrication. He said we were mutually on the same page and believed that the manufacturer's warranty was irrelevant if he had lost 40% of his wire rope life using their coating product and following their procedures. Those procedures included labour intensive manual spray application.

His boom hoist cables had always been shipped previously to him with a viscous lay-up coating that seemed to preclude the issues he was experiencing using the low viscosity oil product.

He asked if he could send two new reels that had not yet been placed in service to TKG to pressure lubricate with our high viscosity Dynagard. We agreed and performed the process with our wire rope lubrication system at a local wire rope distributor. It was mutually understood that this would be the only time the cables could be pressure lubricated because once they were in place on his cranes they would be too close together to accommodate the width of our 4.25" lubrication collar. They would then be required to apply the Dynagard Blue by hand for follow-up maintenance.

The end result for this customer was, even though his subsequent maintenance was not pressure applied, his boom hoist



Dry core: gouges





Boom hoist cable outer circumference: broken strands



longevity went back to where it was previously at a full 100% using the more viscous Dynagard Blue over coating the layer pressure lubed by us before we returned his ropes for reinstallation.

Through the core?

The above term is so often used in reference to the application of wire rope coatings using either manual methods or pressure applied methods. However, this is especially true in reference to pressure application due to its very description that indicates much better penetration than manual coating that more often than not, only coats the wire rope surface. 'Through the core' was our strongest selling point when we first introduced pressure lubrication and we have many photos of our system penetrating to the core of wire ropes over the years. However, as we have travelled down this road, it is not always the case. There are factors that prevent penetration through the core and many are not a negative and have nothing to do with a failure of the technology or performance of our wire rope lubrication systems. At the end of the day, our systems allow a wire rope to pass through a 100% pressurised/consistent immersion not available using manual hand application.

Even so, many lightweight oil products are sold with the selling point of penetrating to the core. Although they may have good corrosion preventing attributes, we have found that most only wash out or emulsify the pre-existing lay-up material. Once that is gone, the oil product must assume full protection against friction wear caused by fluid film breakdown. The oil must then be also used in the maintenance schedule on a more frequent basis over the previous higher viscosity product to maintain the same friction wear protection. Why? Oil goes away quicker and offer a much thinner protective layer.





In conclusion

I believe that TKG has designed the most efficient wire rope lubrication system available today. We understand what is required to provide the end users we serve with the right system for their specific application prior to purchase and then to maximise their use of that system once it is received shipboard. This can only be accomplished from our own experience in the field and input from third parties such as shipboard end users' actively involved in wire rope preventative maintenance.

This knowledge is essential for our support of the over 500 ships integrating our systems into their shipboard wire rope maintenance owned by some of the largest shipping companies in the world. Add to this number approximately 800 Navy and Coast Guard vessels our company supports as well and our experience speaks for itself.

To reaffirm this, TKG has received many testimonials over the years that have come unsolicited through third parties. Their evaluations and opinions concerning the performance of TKG products came directly from their own successful use of it in their respective wire rope preventative maintenance programmes.

TKG has a good understanding of most of our end users' maintenance operations because we owned a 400 crane rental fleet. We have addressed many of the same preventative maintenance challenges and the logistics required in addressing those challenges that our customers encounter. This experience allows our group the ability to analyse their applications so that we can provide them with the best product mix possible. This is true whether we address the requirements for offshore cranes, mooring lines, anchor lines or tow ropes.



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