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Wire rope lubrication: why, how often and how much

TECH TIP 6

Draka Elevator gets quite a number of questions about wire rope lubrication: How often? How much? What method? Should wire rope be lubricated at all?

A regular program of wire rope lubrication is essential to the life and health of your installation. This Tech Tip addresses many of the more frequently asked questions about rope and lubrication.

If wire ropes are manufactured with lubrication in them, why is field lubrication necessary?

Ropes operate over sheaves to create traction; there is no traction if there is no friction between the ropes and the sheave. Too much friction and you cannot break traction - too little and you have slippage.

In many ways, wire rope is a machine like an automobile engine, with dozens of parts that require lubrication to keep working properly. A standard hoist rope like an 8x19 Seale consists of 8 strands with 19 wires in each strand. That totals 152 moving parts within the wire rope. All these parts move when the rope goes over the sheave.

New ropes contain the lubricant necessary to let these 152 parts operate smoothly. However, the constant motion and compression caused by traction will transfer a film of lubricant to the surface of the sheave. Without field lubrication, the rope will age quickly and have to be replaced well before its normal life expectancy.

What happens if the ropes are not field lubricated?

Ropes are under constant pressure as they are being squeezed by the sheave groove. This friction causes the lubricant to oxidize and lose its viscosity. Friction between the wires and strands of the rope causes internal notching while lack of lubrication on the outer wires increases crown wear. The damage caused by this friction could cost a rope 20 to 30% of its anticipated service life.

There are other factors to consider. Most cities experience some level of hot and humid weather; lack of protective field lubrication will cause the rope to dry out and permit ingress of damaging moisture. (See Draka Elevator Product's Tech Tip #5 for further explanation of how water can attack the rope core.) This moisture will cause the core to degrade, which will result in rouge and shorten the rope's life even beyond that of the friction mentioned above.

But the damage does not end with the rope. Like the pistons and bearings in a car engine, there needs to be a lubrication buffer between the ropes and the sheave. If there isn't, the ropes will lose diameter due to internal notching from a dry core and external excess abrasion on the crown wires.

Remember that ropes are harder than sheaves. As rope diameter decreases, it creates excess friction that will amplify groove wear. The damage caused by running an unlubricated or undersized rope could also require the regrooving or replacement of the sheaves. This repair could cost tens of thousands of dollars. What's worse is that it could have been easily prevented by the use of a few dollars worth of lubricant.

Is field lubrication more important today than it was years ago?

Definitely. There is a great deal of difference between a modern elevator system and one of fifty years ago. Older systems used large diameter sheaves with U-shaped grooves. Today's systems use smaller diameter sheaves with undercut grooves for increased traction (which results in a sharper bend radius and increased groove pressure). These factors combine to create greater stress on the rope and sheave that accelerates lubrication loss.

Modern operation also increases rope stress. If the Empire State Building were built today, it would have fewer cars that would cycle more often because of traffic analysis combined with computer elevator control. In addition, cycles of smaller loads are caused by workplace issues like flex-time schedules and anti-smoking laws that cause waves of people to run down to the lobby for their cigarettes.

New environmental conditions also affect rope life and lubrication policies. Ironically, today ropes are exposed to more moisture than in the past because control rooms are now air-conditioned (computer elevator controllers require A/C). The ropes go from a cool, dry control room into a warm, humid hoistway. This causes condensation to form on the ropes and creates a potential entry point for moisture to reach the core, especially when air movement in the hoistway tends to dry out the ropes. Good field lubrication policies will fight these factors and greatly extend your rope and sheave life.

What are the signs of a rope needing lubrication?

If there is no established lubrication policy, the easiest way to check the ropes is to stop the car and lightly wipe a finger on the ropes. This finger test should show a visible and slippery film of oil. If there is no film, the ropes are in desperate need of lubrication. If the film is visible but does not feel oily, then the ropes need a light amount of lubricant. In the past, mechanics were taught to put their finger in the

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TECH TIP 06 0212

groove of the sheave to check for the slippery film. This method is no longer acceptable because as ropes dry out, lubrication will be deposited into the undercut (where the rope has no contact). The finger test will show a tacky black smudge but the ropes could still be bone dry.

What type of lubricant should be used?

Only use lubricant that has been specifically designed for elevator wire ropes. Generic 'wire rope lubrication' like that used for crane wire rope is unsuitable for elevator use; it may cause slippage and other problems.

There has always been a need for a field lubrication that deals with the bending stresses, high groove pressures and moisture that attack elevator ropes. That need has been recently addressed with a new generation of lubricant with additives that fight corrosion, wear and, most importantly, can actually displace water in the ropes core. (Lost lubricant is normally replaced by moisture, which can lead to rouge.)

This lubricant (now available from Draka Elevator Products under the name of DrakaLube™) has been tested in an elevator that operated within a dam in the Rochester area of upstate New York. Prior to the use of DrakaLube, untreated ropes lasted no more than two years and were condemned due to corrosion, rouge and wire breaks.

New ropes were installed and treated with DrakaLube on a regular schedule. The ropes still show no sign of corrosion or rouge and are now in their third year of operation. (Note: no lubrication can displace water in ropes that have been soaked or immersed in it – see Tech Tip #5.)

What is the best way to apply lubrication?

Automatic lubricators are the most time-efficient way to lubricate ropes. Make sure to manually lubricate the ropes that are over the sheave when the car is at its lowest landing, as the oiler does not touch that section of the ropes. Manual methods, such as using paintbrushes or rollers, are still acceptable.

What is the best field maintenance policy?

Draka Elevator strongly recommends an annual lubrication application every spring (NOTE: governor ropes must NEVER be field lubricated.) Ropes should be field lubricated prior to summer and the increased temperature and humidity it brings. The summer is when the air conditioners in the machine rooms and offices are operating. Condensation caused by the combination of an air conditioned machine room and a humid hoistway must be kept from entering the rope core.

The amount of lubricant to be applied is a critical question. The rope needs to have enough lubricant to eliminate friction in the wires and strands but not enough to cause slippage in the sheaves. The recommended amounts are very conservative so as not to cause over-lubrication. Start with the small amounts as shown in the Table 1. Run the ropes for 30 days and if they feel dry, add additional lubricant as shown in Table 2.

In both tables, the amount of lubrication is based on 1,000 feet of rope. For instance, if there are six 1/2 inch ropes to a set and they are 500 feet long, that's 6 x 500 or 3,000 feet of rope, so 3/4 quart x 3 equals 2 1/4 quarts of lubrication – just a little over half a gallon.

Table 1 addresses bone dry ropes that have never been field lubricated.

Table 1: Ropes that are bone dry

For this size rope...	use this much lubricant
3/8"	use 1/2 qt. of lubrication per 1000 rope feet
1/2"	use 3/4 qt. of lubrication per 1000 rope feet
5/8"	use 1 qt. of lubrication per 1000 rope feet
11/16"	use 1 1/4 qt. of lubrication per 1000 rope feet
1"	use 1 1/2 qt. of lubrication per 1000 rope feet

Table 2 addresses ropes are dry to the touch but there is still some visible film on a finger; or if you are performing annual spring lubrication; or if you have used the amounts in Table 1 and the ropes are still dry.

Table 2: Ropes that are dry to the touch

For this size rope...	use this much lubricant
3/8"	use 1/4 qt. of lubrication per 1000 rope feet
1/2"	use 3/8 qt. of lubrication per 1000 rope feet
5/8"	use 1/2 qt. of lubrication per 1000 rope feet
11/16"	use 5/8 qt. of lubrication per 1000 rope feet
1"	use 3/4 qt. of lubrication per 1000 rope feet

Prior to lubricating, clean all lubrication build-up and dirt from the ropes using an automatic metal-brush cleaner or wire brush. DO NOT use solvents to clean ropes; solvents will break down all the rope lubricant and the rope will deteriorate.

Along with field lubrication, tensioning is the most important thing that can be done to wire rope to reduce maintenance and overall costs. A well-lubricated rope with poor tensioning will still shorten rope and sheave life; it may just take longer for the problem to arise. (See Draka Elevator Tech Tip #10 for more information on rope tensioning.)

An important final note:

This tech tip addresses general field lubrication rules. Every car is different in number of cycles, sheave size, groove profile, groove pressure and environmental conditions. If the ropes still produce a good oily film on the finger test during the spring check-up, you may want to increase the maintenance time to a year and a half or two years. While testing and judgment are important, do not totally put off maintenance.

A regular program of field lubrication will help keep ropes and sheaves in good working order and increase their lives. Remember, a few dollars a year of lubricant can save thousands of dollars in repair and replacement costs.

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