What to do when wire ropes get wet

TECH TIP 5

Draka EHC gets asked this a few times a year and this isn't as unusual as it sounds. Wire rope becomes exposed to dampness because of high humidity in the hoistway. And while a building fire may be far from the hoistway, water from the fire fighting effort may fill the pit as well as saturate the ropes.

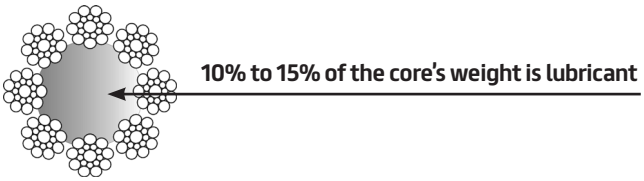
It needs to be understood that standard bright (uncoated) elevator ropes are designed to operate within an enclosed, protected and dry environment. Whether the water comes from humidity, condensation, by a thorough soaking from a sprinkler system or a broken water pipe, a wet rope poses several concerns, such as:

- Is there anything in the applicable code that covers wet ropes?
- Are the ropes permanently damaged?
- Can this situation be corrected?
- Should ropes be replaced before problems appear?

HOW WATER EFFECTS WIRE ROPE

To understand how water acts on wire rope, we need to first examine how rope is made as well as dispel a myth about how the rope's components operate.

Wire ropes are designed with various cores and wire types to meet operational demands. The most common construction features a core made of a natural fiber called sisal. (Other core types include Independent Wire Rope Cores [IWRC], mixed core and synthetic fiber.)



During manufacturing, a low-viscosity lubricant is applied to the sisal and strands of the ropes. The main purpose of the lubrication is to give 'life' to the rope's working parts and allow traction to take place. This lubricant also reduces metal-to-metal friction when the rope is operating and helps inhibit rust formation. It typically accounts for 10% to 15% of a sisal core's weight.

A common myth in the elevator business is that the purpose of a sisal core is to wick lubrication through the rope. While wicking is a natural function of a sisal core, it is not its main purpose. The core's main function is to support the wire strands during the rope's operation and keep the rope round under the sheave's groove loads and pressures. Also, core lubricant is viscous and would not wick far under the best of conditions.

While different lubrication formulas can increase the rope's life and performance in various temperatures and environments, typical elevator rope lubricant does NOT incorporate any environmental protection properties for the sisal core. Once a rope gets wet, the trouble begins.

HOW WATER GETS INTO THE CORE

Lubricant and water are carried in the core differently. Lubricant encapsulates the sisal fibers and strands and fills the spaces between them; water is actually absorbed into the sisal itself. Water in any form will accelerate the biodegradation of the sisal. Even during normal operating conditions in a protected environment, water can attack core integrity in two ways:

Humidity: The worst case of this occurs in the Southeast and the Gulf states where summer heat and humidity are high. The sisal core absorbs this humidity causing the biodegrading process to start sooner than in dryer climates

Condensation: This can happen anywhere. Ropes operate in the hoistway where they are exposed to heat and humidity and then cycle into an air-conditioned machine room. If the ropes stay in that position for even a short period of time, you can actually feel the condensation develop on the ropes.

The sisal core absorbs this liquid moisture where it accelerates core degradation as well as rouging (see How Moisture Causes Rouge below).

LUBRICATE AGGRESSIVELY IN THE FIRST SUMMER

A frequent and aggressive lubrication policy is recommended when the ropes are going into their first summer. The goal is to keep enough lubricant on the outside of the ropes so that moisture has difficulty penetrating the core. This approach will decrease moisture absorption/wicking and give the rope longer life. Apply just enough lubricant to the ropes so that when a finger is lightly wiped on the rope, there is a visible and slippery film of oil. Do not over-lubricate. (See Draka EHC Tech Tip #6 for more information on rope lubrication.)

Unfortunately, once the water gets in, it cannot be expelled by addi tional lubricant. Again, the purpose is to use the lubricant as a shield against further moisture ingress and to continue to reduce friction between the movement of the wires and strands.

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What to do when wire ropes get wet (cont'd)

HOW MOISTURE CAN SHORTEN THE LENGTH OF A WIRE ROPE

During extremely humid summers, absorbed humidity can swell the core. This causes the rope to push the strands outward; this increases the diameter, which decreases the length. (This is the exact opposite of 'stretch' where the strands seat themselves deeper into the core so that the rope becomes smaller in diameter and increases in length.)

This swelling can be very pronounced in governor ropes, which by ASME code CANNOT be field lubricated. It is not unusual to see a governor rope developing a 'coke bottle' profile where the rope is visibly fattened and thinned in various places. This expansion/shortening effect can actually lift the governor tension sheave.

As the seasons change, the ropes dry out, the core contracts and the strands elongate to allow the tension sheave to drop back down. (The same thing can happen with compensation ropes, although they can be lubricated to help prevent this condition.)

Does over-lubrication have the same effect on the core as humidity/moisture and cause the ropes to expand and contract the same way? No. Lubrication does not penetrate the fibers. It sits between the fibers, surrounding and encapsulating them. However, the sisal absorbs water and this absorption is what causes the expansion of the core. Over-lubrication can throw lubrication on the ceilings and walls in the machine room. Slippage problems may also be encountered and the ropes may begin looking like black rubber hoses.

DIRECT WATER CONTACT

There is nothing in the ASME code that covers the situation of ropes becoming saturated because of pit flooding and/or spray from water sprinklers. However, prudent engineering practices and common sense dictate the answers to the following questions:

Are the ropes permanently damaged? Yes. Wet ropes have a very short life expectancy. Methods that might mitigate a problem caused by humidity or moisture will not save a rope saturated with water. Even if a rope gets soaked just in one area, the core will wick the water to the rest of the rope and biodegradation will begin. Car motion and gravity just accelerate this process.

What problems are caused by wet ropes? The ropes will expand in diameter and get shorter, lifting both the governor and compensation sheaves. Wet ropes will impact the leveling of the car. Well-intentioned but useless over-lubrication could produce slippage and blackened rope. Coke-bottled ropes have the same effect sliding over a drive sheave as a serrated knife going through stale bread.

Should wet ropes be replaced before problems become evident? Yes. Wet ropes need to be replaced immediately. They damage sheaves, cause service problems and can conceivably cause personal injury to a passenger. It should be noted that if flooding or sprinklers caused this situation, insurance might pay for the ropes to be replaced, but most policies have a time limit for discovery and acting on fire-related damage. Fast action now will prevent expensive problems later.

HOW MOISTURE CAUSES ROUGE

Rouging always occurs from the inside out and happens as the core hits its life expectancy or if humidity, moisture or water is introduced into the core. Water sitting on ropes will cause surface rust to form within a couple of days. Rouge happens when the core deteriorates and no longer supports the rope's strands. The sisal biodegrades, the wire strands collapse and begin internally rubbing against each other. This friction grinds off fine particles of steel that work their way through the rope's strands and oxidize, causing the red dust or rouge.

NON-SISAL CORES AND MOISTURE

Independent Wire Rope Cores [IWRC] and synthetic fiber cores mentioned earlier do not absorb water or biodegrade. Water introduced between the strands could cause rust but not to the degree of a sisal-core rope. Lubrication that displaces water, such as DrakaLube™, helps solve this problem for all styles of cores (except when a rope has been completely soaked).

AVOID MOISTURE BY CAREFULLY STORING THE ROPE BEFORE INSTALLATION

Never store elevator ropes where they are exposed to the environment. Outside storage is not recommended. In fact, ropes should be stored indoors under a heavy tarp to protect them not only from moisture but also from dust and debris. Concrete, drywall and sawdust can mix with rope lubrication and potentially create excess stress on the moving strands, which shortens the rope's life. What appear to be spots of accumulated lubrication on the ropes may actually be a mixture of lubricant and the various dusts found on the jobsite.

CONCLUSION

Water in any form means trouble for wire rope. To minimize damage caused by moisture and to lengthen the life of your ropes, remember to lubricate often (avoid over-lubrication), especially prior to summer in hot and humid environments. Surface oiling is your best defense against moisture ingress. While lubricant will not easily wick up the core, water will. Remember that water is always looking for a way in. If a rope becomes soaked, replace it as soon as possible.

A FINAL NOTE ABOUT DRAKALUBE

DrakaLube wire rope treatment has been specifically formulated for use with all types and brands of elevator wire rope to fight bending stresses, high groove pressures and moisture. DrakaLube is a new generation of field lubrication with additives that provide protection against corrosion, wear and most importantly it can actually displace moisture in the rope core.

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