Lubricant Build-up

Lubricant build-up on elevator rope is a condition which for years has frustrated maintenance personnel and inspectors. In recent years build-up has become more prevalent; today it is not uncommon for a wire rope to resemble a black rubber hose (see Figure 1, rope 1), or an undercut U- or V-groove to be mistaken for a U-groove because of the amount of build-up in the groove.

To answer the growing concern over lubricant build-up, Wirerope Works, Inc. (WW) actively investigated lubricant build-up, a condition occurring on all manufacturers equipment and with all brands of wire rope. Over a period of years WW collected and analyzed many samples from various buildings, geographical areas, speeds, weights, groove configurations and from a cross-section of manufacturers of equipment and ropes. The following are WW's findings.

Content Analysis

The contents of the lubricant build-up fall into two major categories: solids, or metal fines (shavings) from sheaves and ropes; and non-solids, excess lubricant filled with contaminants.Solids were found in all samples analyzed. In some instances solids comprised 90% of the total content of the lubricant build-up. No sample analyzed contained less than 20% solid content. Site contaminants comprised the remaining portion. It is also important to note that a few samples contained nearly 2% water.

Contributing Factors

Sheaves

The relationship of rope diameter to sheave diameter has changed dramatically. Years ago ropes ran on large sheaves; today the trend is moving towards the allowable minimum of 40 to 1 (i.e. 1/2" diameter ropes on 20" sheaves). Undercut U- and V-grooves compensate for the loss of contact area, resulting in increased abrasion of the ropes and sheave. In these cases WW discovered the solid content to be very high. Samples collected from older equipment using large U-groove sheaves (where the sheave had not been regrooved) also contained a high metal fines content. Wire rope reduces in diameter throughout its life. As it reduces in diameter, the rope continually machines the sheave groove to fit it's diameter, producing metal fines. With each new set of ropes the process begins again. When the sheave is not regrooved, the groove profile will be considerably smaller than the diameter of the new rope, increasing the amount of metal fines and forcing lubrication out of the rope, thus accelerating lubricant build-up. In years past metal shavings at the base of the machine, with which many mechanics and superintendents are familiar, indicated that the sheave was wearing. Today this condition is masked as part of lubricant build-up, or metal fines and other contaminants mixing with the lubricant.

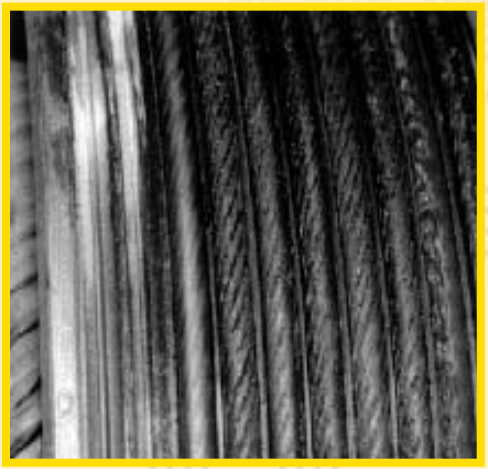

Figure 1: **Lubricant Build-up**

Over Lubrication

In many cases over lubricating wire rope is the major cause of lubricant build-up and contamination. Suppliers of automatic lubricators state that the electrostatic process of lubricating wire rope results in the rope's taking "only what it needs." This is incorrect. The fact is the electrostatic process will continually feed lubricant to the rope well beyond its absorption point. The excess lubricant is thrown off and/or exudes from the rope and combines with site contaminants to create the "black rubber hose" effect. There are economic advantages to using automatic lubricators. However, service technicians must realize the limits and subsequent effects of these lubricators when not used properly. Likewise, pouring a gallon of lubricant over the ropes is just as detrimental. Excess lubricant attracts site contaminants and may cause slippage. Refer to Bethlehem Elevator Rope Technical Bulletin 2, *Lubrication* for further information.

Carbon Dust

Dust from carbon brushes has been a major problem as a contaminant not only for wire rope but other components of the elevator system. WW's analyses revealed carbon dust as another component of the build-up.

Air Conditioned Control Rooms

WW observed during multiple inspections that cars nearest the air conditioner exhaust vents have a much greater potential for lubricant build-up. In this case, as also was the case in high humidity conditions, the sample water content was as high as 2%. Due to the warm, humid con-

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ditions of the shaft, air conditioned control rooms will cause condensation on the ropes when the ropes cycle into the control room even for a short period of time. The condensation mixes with contaminants trapped in the lubricant and causes a high moisture content in the build-up.

Incompatible Field Dressings

For some reason gear oil, motor oil and hydraulic fluid are sometimes used as wire rope lubricants. WW recommends only a light viscosity spindle oil. Any lubricant with detergents or solvents is incompatible with the manufacturing lubricant.

Airborne Contaminants

WW inspected an elevator in an older building and found lubricant build-up in the mid-rise, with no build-up in the high-rise. Further, the inspection revealed the following:

- The large U-groove sheaves were regrooved to specification.
- No automatic lubricator was used.
- The ropes were not lubricated in the field.
- The ropes were only one year old.

The build-up was comprised primarily of non-metallic solids. Further examination led to a discovery: renovation activity in the mid-rise area. Several factors were involved here which would not have been present in the past. Dusty, inexpensive sheet rock was used in lieu of plaster, the carpets were synthetic fiber and the air circulated through the elevator/ventilation shaft, bringing dust and fibers into contact with the elevator ropes. Contaminants will adhere to any surface with a greasy or sticky film. Often it has been observed that a build-up of lint surrounds the ropes above the shackles where the ropes do not pass over the sheaves. The electrostatic charge in the ropes acts as a magnet to airborne particles.

Rope Brakes

These safety devices use friction pads to stop the car in emergency situations.In many cases the pads need to be grooved to fit the number, size and spacing of the ropes. Typically the ropes are used to groove the friction pads, creating particles that ultimately mix with the manufacturer's lubricant.

Rope Cleaning Methods

Due to the wide variety of causes of lubricant build-up, at this time the key to controlling lubricant build-up rests solely on maintenance personnel. Inspectors will issue a violation if they cannot inspect the crowns or valleys of the ropes. Therefore, rope cleaning is imperative. Build-up may cause severe abrasion on the ropes and sheaves if the solid content is high. The lubricant and metallic fines combine to act as a cutting or polishing media between the ropes and sheave. Conversely, a high non-solid content may cause slippage. Additional lubrication is useless under these conditions since it will not penetrate to the core.

Solvent

The use of a solvent will not only break down the exterior lubricant build-up, it will also break down the lubrication in the core, resulting in a dry rope and subsequent rouge. Solvents are unacceptable.

Carpeting

In the past carpeting mounted in the rope guards was commonly used with success. Most carpets then were made from natural fiber. Today most carpets are synthetic, not biodegradable, and add to the problem of contamination. In addition, the use of carpeting may be in violation of fire codes. Therefore the use of carpeting may be unacceptable as a means of cleaning wire rope.

Wire Brush

Manual labor with a wire brush is costly in terms of labor, but remains an acceptable method of cleaning the ropes.

Automatic Rope Cleaner

A proven automatic rope cleaner is available and being sold commercially to clean ropes without expensive manual labor. Patented and licensed to Parts Specialists, Inc., the rope cleaner cleans hoist ropes as they cycle in everyday operation. The only labor involved is in the initial installation and periodic removal of build-up from the cleaner's surrounding areas. It should be noted that car tops need to be protected from falling lubricant build-up. Once the ropes are clean a very light field dressing should be applied. For further information contact your Bethlehem Wire Rope® distributor or WW at 800-541-7673.

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