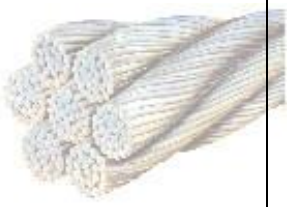
"Haggie Hints"



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Haggie North America Inc. - Meeting your hoisting needs!

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A Unique Structural Upset on a Koepe Hoist Rope

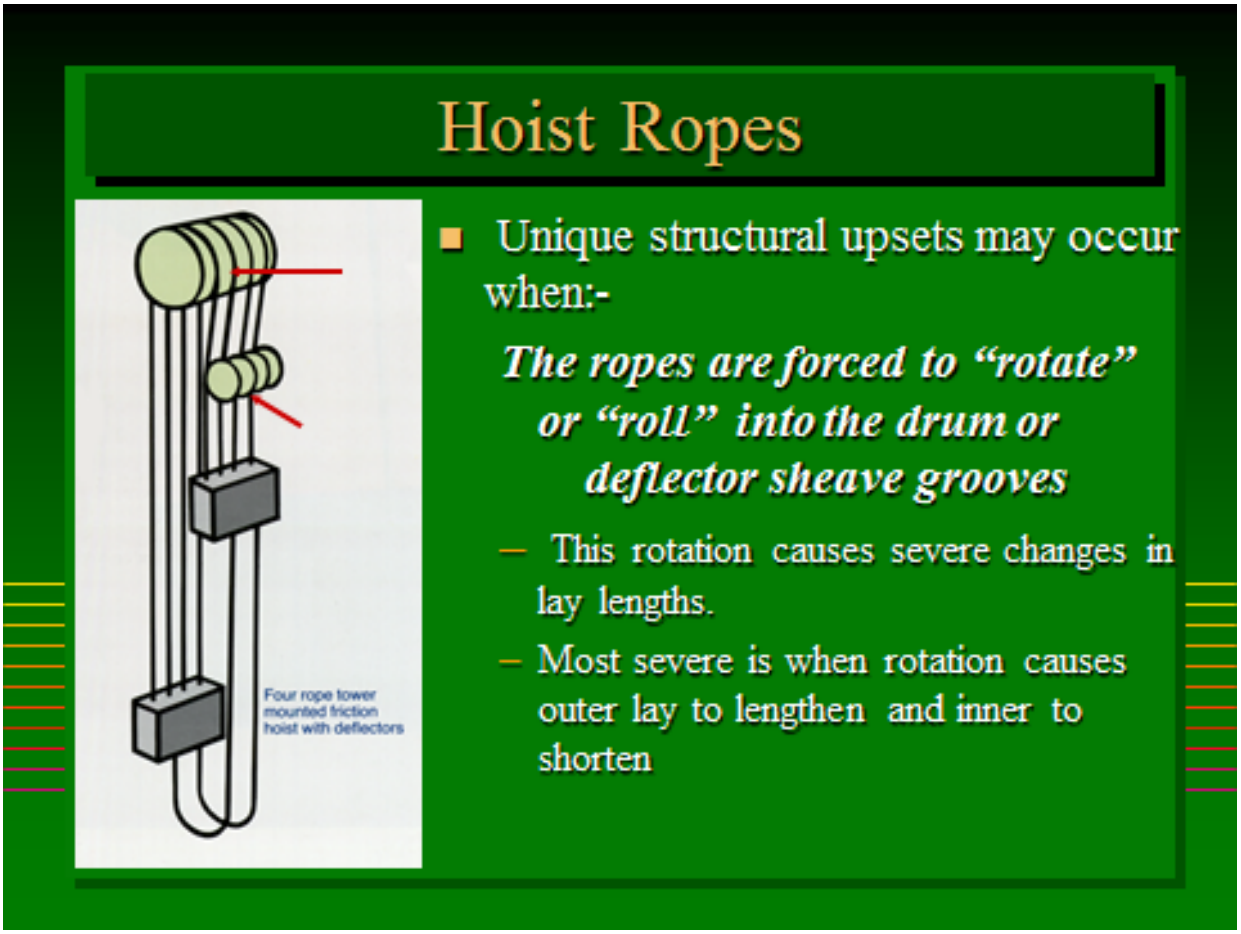
DISCUSSION:

Over the past 20 years or so, there have been several cases when a unique structural upset has occurred suddenly in a Koepe hoist rope. Although this is not a frequent problem and while the cause of the upset is elusive, it is well worth understanding the root cause and perhaps avoiding such issues.

In a few cases, the hoist ropes were Full Locked Coils and in another, it was a Stranded Non-Spin. The appearance of the upset in each construction is dramatically different but the cause is identical.

The upset results when a hoist rope is forced to roll into the bottom of the friction winder groove. What is most surprising is the very small entry angle that will cause this to take place. Based on at least three different cases, the entry angle was calculated to be in the order of **0^0 4'** or **0.0667** degrees. In each case, the problem was resolved when the ropes were allowed to enter cleanly into the groove bottom.

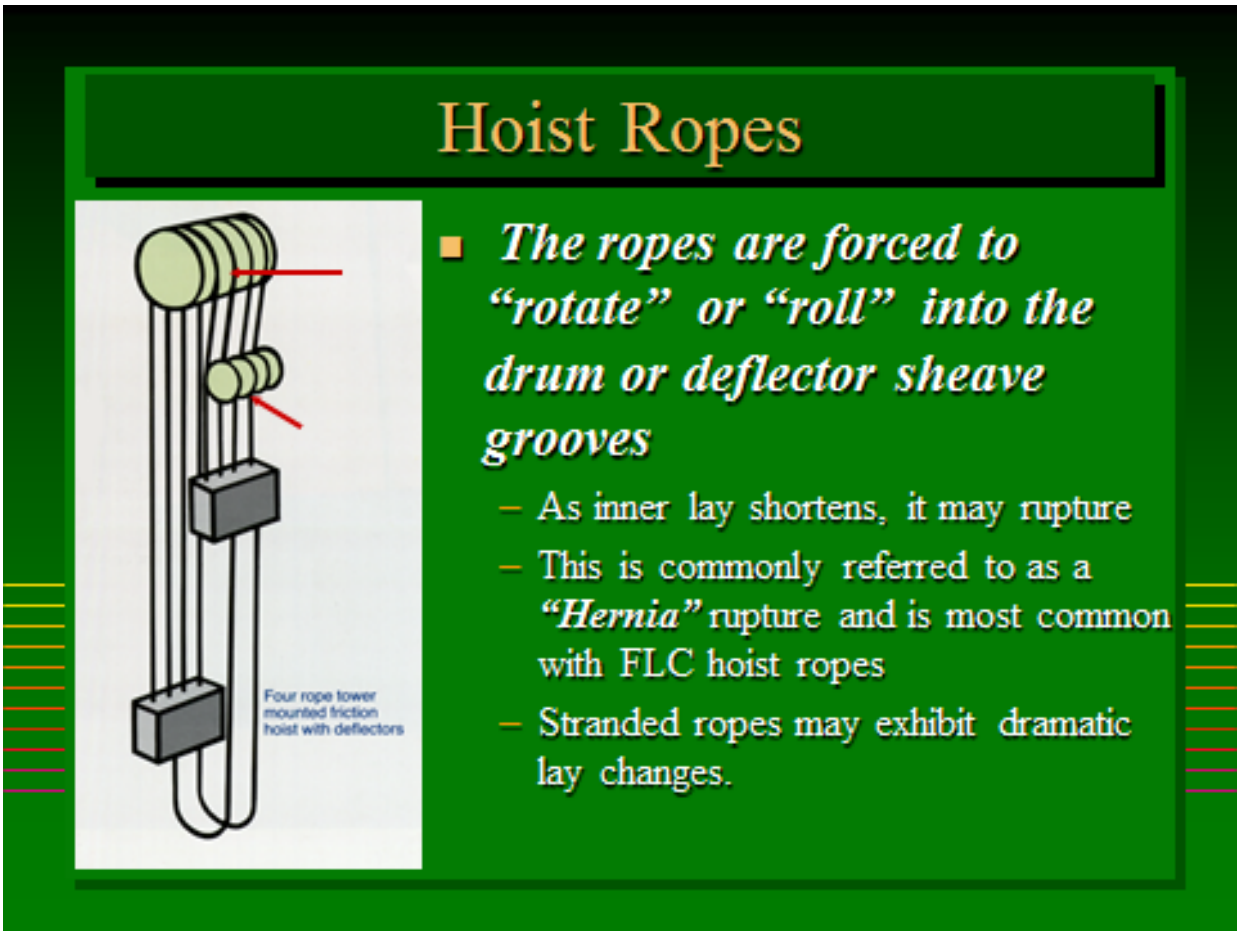
While it is possible for the entry angle to cause a rope to rotate in either direction, the most noticeable reaction is when the rotation causes the outer cover "lay" to lengthen. The upsets are located as shown on this slide.



In the case of the FLC hoist rope, the upset appears fairly innocent at first glance, but as the rope is dismantled, the true extent of the damage is revealed.

With a stranded non-spin hoist rope, the upset is more subtle and the noticeable change is a significant lengthening of "lay" in the outer layer, with the upset potentially covering a substantial distance – perhaps 5 to 10 meters.

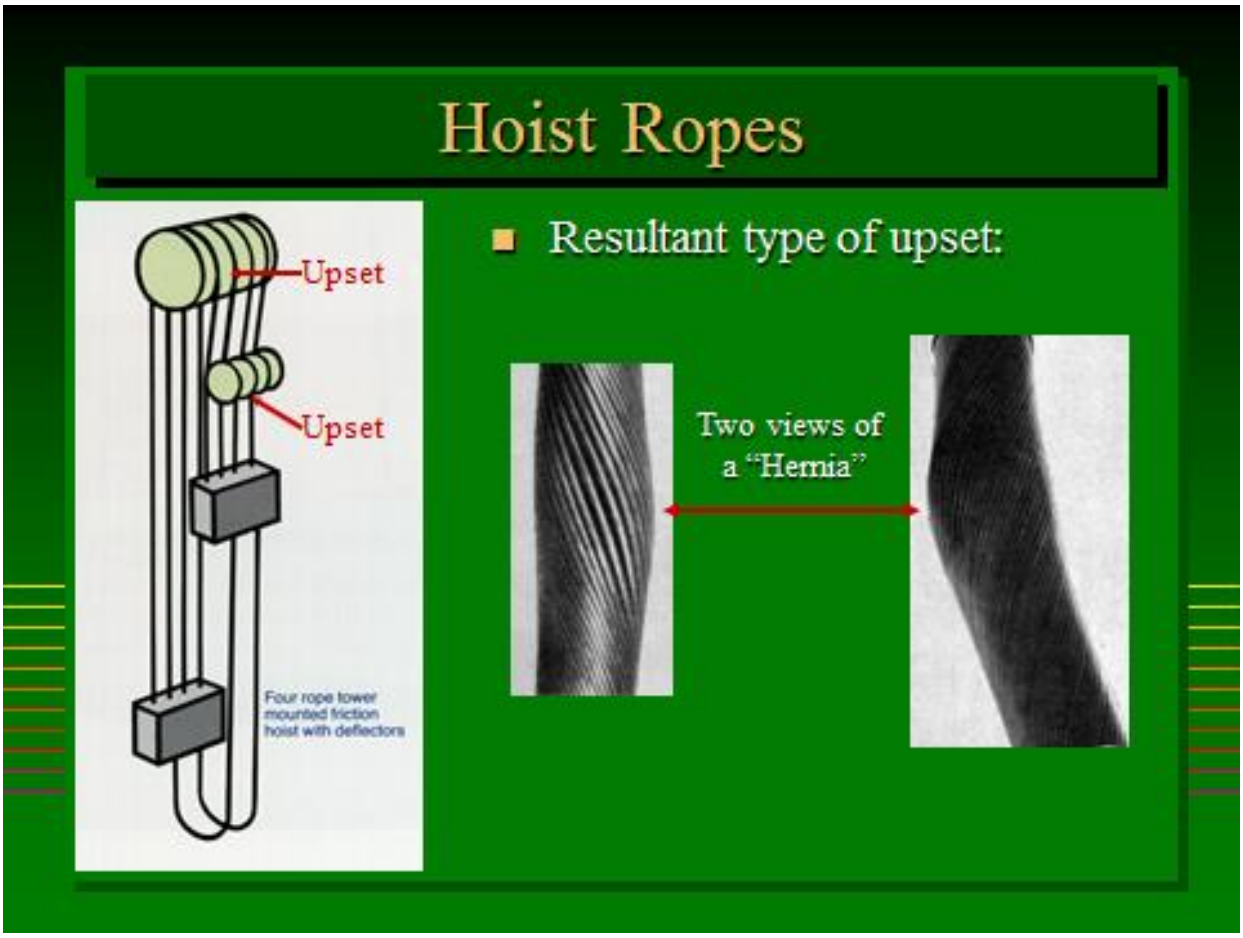
The reason for the difference in reaction is the stiffness factor between the two rope constructions. The FLC behaves virtually like a flexible steel rod so the reaction of the outer layer unlaying versus the inner rope being tightened is confined to a short distance whereas the stranded non-spin is spun more loosely, so the changes in lay lengths are dispersed over a longer length.



FLC UPSET (Hernia Rupture):

The slide below illustrates the external appearance of the hernia which appears to only be a swelling, or shows a relatively small increase in rope diameter.

The photos shown are those of a 1.515" diameter FLC so it can be seen that the upset is confined in length to 3 or 4 rope diameters.



The next slide shows each layer as they are removed. The condition of the interior is fairly startling.

STRANDED NON SPIN UPSET:

Unfortunately, I do not have photos of the one case I witnessed with this construction; however, the lay length had increase by about 100%.

HISTORY:

As was stated before, the angle required to initiate this type of upset is very small and it was determined "after the fact" or in other words, it was arrived at after at least three separate cases where the resultant entry angle where similar.

Each of the three cases involved a Tower Mounted Friction Winder.

The hoist ropes in the first case were 1.515" diameter Full Locked Coils and over a number of years, there were perhaps 5 or 6 occurrences of Hernia Ruptures. Over this period of time, the system was inspected and analyzed by many "experts" but with no explanation found. It wasn't until the on-site foreman noticed that the conveyance drawbar was not actually welded to the skip body but was rather a "triangular" plate that was pinned below the structure. He found that rather than being horizontal, the drawbar had actually tilted so that in effect, the rope centers were no longer the same as the drum grooves. Calculations showed that the angle difference was about 0^0 4'. Once the drawbar was fixed rigidly in place, the problems of the hernias disappeared.

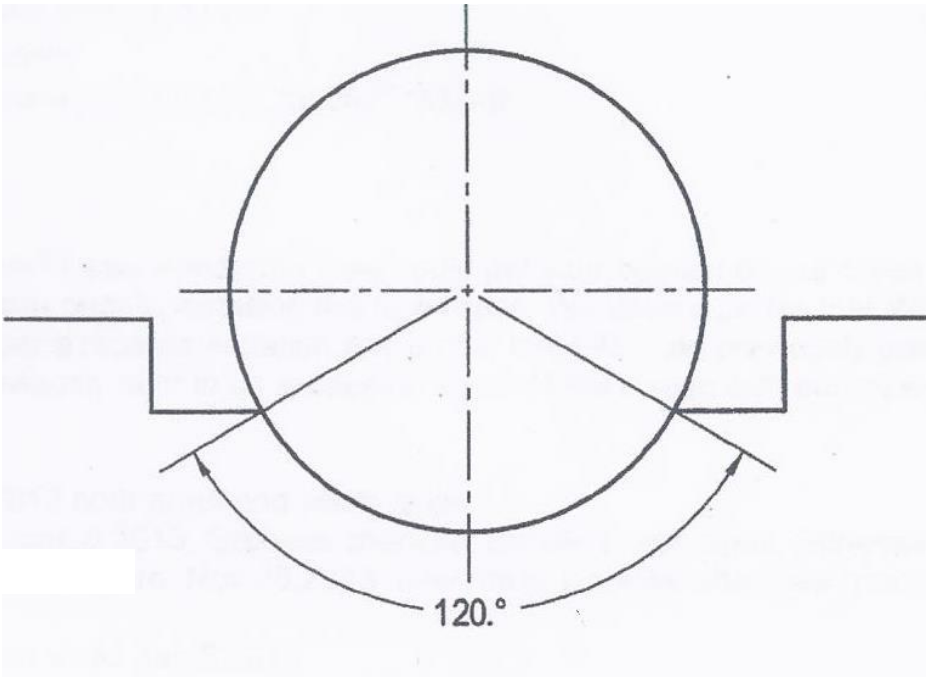
The second case involved stranded Non-Spin hoist ropes with one of the outside ropes consistently developing an extremely long lay length just at the tangent point of the drum and extending towards the deflector sheave. It was obvious from the lay change that the rope was being forced to rotate and it was discovered that the deflector sheave was not properly aligned with the drum grooves and was off center by a small amount. When the calculation of the entry angle was performed, it came out at about 0^0 4'.

In the third case, Hernias were developing in the FLC hoist ropes and after much investigation, it was found that the hoist drum was no longer horizontal because of a bearing issue and once again the entry angle was calculated as being in the order of **0^0 4'**.

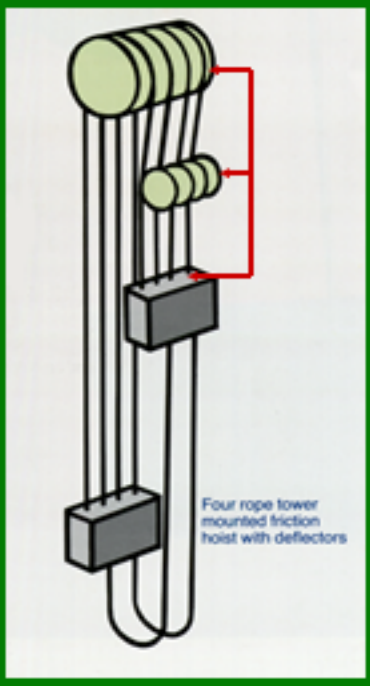
CONCLUSION;

In most instances, rope alignment should not change unless there is an accident but if there is a rope reaction as described in this bulletin, then the most likely cause will be related to an "entry" angle existing somewhere in the system. This type of upset is not due to a rope manufacturing problem but is definitely an application issue.

In addition, an entry angle can also exist due to rope whip so it is imperative that as the grooves in the drum or deflector sheave wear to approaching ½ of the rope diameter, the sides of the grooves be "relieved" to avoid contact and thus removing the possibility of the rope rolling into position.
Here is a diagram of the ideal groove profile:



Hoist Ropes



- CAUSE of UPSET -

The rope being forced to "rotate" into the drum or deflector sheave grooves – <u>An angular deflection of 0°4' can cause the upset!</u> **The effect is greater when a high coefficient of friction exists**

- CURE - Ensure rope enters the groove without interference
  - If the grooves are worn > 1/2 rope dia., then machine a relief angle
  - Closely check rope to groove alignment between conveyance in uppermost position, the deflector sheave and the drum
  - Verify hoist is level